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ABSTRACT

A developmental project created and field tested a computer-assisted instructional (CAI) unit in dental diagnosis. The main objectives were to determine 1) if, after having received CAI, the dental student could determine whether a patient had a clinical need for space management and 2) if the dental student's attitude toward CAI and space management remained favorable. Senior dental students and dentists already in practice took cognitive and affective pretests and then received the CAI product in which pediatric space management cases were presented via various media. A typewriter terminal connected to an IBM 360/50 computer provided control of the instructional sequence and immediate corrective feedback to the subjects' typewritten diagnoses. The computer program was written in the PILOT author language. Posttest results indicated that both objectives were successfully achieved, for the subjects met the minimal standards for diagnosis and their attitudes remained as positive as they were at the beginning of the project. (Author/PB)

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University of California

Los Angeles

COMPUTER-ASSISTED INSTRUCTION IN DENTAL DIAGNOSIS A SYSTEMATIC PRODUCT DEVELOPMENT

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Final Report

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ABSTRACT

The aim of this project was to systematically develop and field test a computer-assisted instructional (CAI) product in dental diagnosis. Pediatric space management cases were presented to the student through various media. A typewriter terminal connected to an IBM 360/50 computer provided general control of instructional sequence and immediate corrective feedback to the student's typewritten diagnosis. The computer program was written in the PILOT author language.

Generally stated, the two main objectives of the product were:

1. The student will be able to determine whether a given patient case has a clinical need for space management. He will then be able to specify what needs to be treated.

2. Student attitude toward computer-assisted instruction and toward space management will not become less favorable after having taken this product.

The product was designed for use by both dental students and dentists who have been introduced to diagnosis of space discrepancies through some medium of instruction, who have the specified prerequisite skills, and who wish to practice their diagnostic skills and relearn related subject matter where the practice indicates deficiency.

Senior dental students from the University of California, San Francisco School of Dentistry voluntarily participated in the development and

field test of the product. The selection of the field-test sample was made on the basis of a test for prerequisite skills.

The field test included the administration of two pretests, the main product, and two posttests. Evaluation of the cognitive objective consisted of determining whether students reached minimal standards on a diagnosis test. Evaluation of the affective objective involved the interpretation of scores on an attitude questionnaire.

The results of the field test were favorable. The minimally acceptable standards of the cognitive and affective objectives were achieved by the students who completed the field test.

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INTRODUCTION

In view of the dental teacher shortage,[1,4,9,15,28] it may be necessary for dental educators to rely more on new teaching methods, especially those which are auto-instructional in nature. Such methods would not require the constant presence of the instructor in the classroom. More of his time could be made available for other tasks where his presence is required, for example, in the clinic when the student meets the patient.

One such auto-instructional method is called computer-assisted instruction (CAI). It can be distinguished from other forms of auto-instruction in that 1) stimuli are presented by a device controlled by a computer, and 2) stimuli are altered by the computer based upon the responses made by a student using a device which communicates with the computer.

The aim of this project was to develop a CAI product that would provide the dental student with practice in diagnosis of patient cases. Emphasis was placed on developing the product systematically and on designing it to meet the requirements of a "program."[19] The systematic development involved nine phases:[21] 1) formulation, 2) justification, 3) specification of objectives, 4) development of pretests, posttests, and prototype, 5) development of main product, 6) cycles of testing and revision, 7) final field testing, 8) evaluation, and 9) implementation plans. The product had the characteristics of a program in that it was reproducible for use in other dental schools and it was designed to take responsibility for achieving specified objectives.

The remainder of this report will describe how the development was carried out and will present the results of the field test. It is hoped that the findings will show that a systematically-developed CAI program can be useful in dental education.

FORMULATION

In the formulation phase the product was defined, including its purpose, the content area, the intended audience, and the general objectives. This was the first step in the development procedure, and it was simply a matter of documenting those ideas that instigated the product development.

The operational definition of CAI in this project was stated as follows:

1) the displaying of text and questions on a computer typewriter terminal;
2) accepting and analyzing the student's response via keyboard;
3) altering the selection of text and questions for display based on the student's response;
4) maintaining cumulative records on the student's responses.

The purpose of the product was to provide the student with practice in diagnosing dental cases. Space management cases in pediatric dentistry were presented though other dental areas could just as well have been chosen had the circumstaances been as opportune.

The diagnostic practice was designed to be auto-instructional in nature;

the instructor was not required to be present. The patient cases were presented through slides and written descriptions. An interactive computer program allowed the student to request diagnostic aids, submit a diagnosis, receive knowledge of results, and receive remedial instruction where learning deficiencies were detected by the program. (See "Flow Chart of the Interaction" in the Appendix.) At the conclusion of each session with a student, the computer produced a summary report of student performance during his diagnoses.

The product was designed for use by both dental students and dentists who have been introduced to diagnosis of space discrepancies through some medium of instruction, who have the prerequisite skills, and who wish to practice their diagnostic skills and relearn related subject matter where the practice indicates deficiency.

During the formulation stage, the general objectives of the product were specified. They were stated as follows:

1) The student will be able to determine whether a given patient case has a clinical need for space management. He will then be able to specify what needs to be treated.
2) The student will respond favorably when asked whether he would like to continue using this type of instruction and whether he would like it extended to other dental subjects.

JUSTIFICATION

Because of the great effort involved in developing instructional products systematically, it did not seem advisable to undertake such a project unless there was a clear need for the product and unless it could be shown that such a product did not already exist in an acceptable form. The development of this product was justified in both aspects.

As stated and annotated above, there is a serious dental teacher shortage. This CAI product could help to alleviate the shortage. It provides a means by which the instructor can be, in effect, in more than one place at the same time. He can be, for example, physically in the clinic environment and through this CAI product, he can be functionally and dynamically interacting with other students in a laboratory type of learning situation.

The knowledge explosion and information turn-over[31,32] has made it imperative that the dental curriculum stress basic facts that are least likely to become obsolete. Accordingly, dental education is now aiming to train the student how to acquire information for himself, how to evaluate that information, and finally how to appropriately apply it in providing improved dental services to the public.[8] This type of training calls for instruction in the "higher levels of the cognitive domain."[3] It involves decision-making and problem-solving skills of the student. Since this CAI product provides practice in these skills, it is further justified.

The computer was chosen as the implementing device of the product because it seemed to be the one tool that allowed the kind of realism and flexibility that should be present in the learning environment when practice is being offered to strengthen a diagnostic skill.[24] The powers of the computer provided extensive interactive capabilities and thus made the diagnostic practice more realistic. The student was able to respond to the computer in a relatively free-form manner; he was not forced to choose his responses from a selection list. Furthermore, he was able to interrupt his diagnosis to return to request other diagnostic aids. Any remedial instruction given to him could be tailor-made according to what responses and requests the student had already made. In effect, the type of experiences that this product offers are similar to the ones the student will have when he is in the clinic with the patient and the instructor.

Only one extant product in dentistry provides this type of diagnostic practice and it concerns temporomandibular joint problems.[25] There are a limited number of similar products in medical education covering subject areas in medicine.[10,12,26,27,29,30]

SPECIFICATION OF OBJECTIVES

The next step of the systematic product development procedure was the specification of objectives. Prerequisite objectives described the skills which the student was expected to have before taking the product. Target objectives described those skills which he was expected to have after taking the product. Enroute objectives described the skills that the

student had to master while taking the instructional product in order to be able to achieve the target objectives. The enroute objectives were essentially the answers to the question: "What does the student have to learn from this product so that he will be able to do that which is described in the target objectives?" (See "Cognitive Objectives" in the Appendix.)

Determining the enroute objectives was difficult, but nevertheless proved very important. These objectives can be especially helpful to the teacher when he finds that the student has failed to achieve a target objective, because testing the student's mastery of the enroute objectives may provide a clue as to why he was unable to achieve a target skill. As an aid to identifying the enroute objectives in this product, a "task analysis"[13,14] was performed and diagrammed. (See "Task Analysis Tree" in the Appendix.) The analysis was helpful in determining what specific remedial instruction to give to the student if he submitted an improper diagnosis.

Each of the objectives were stated in "measurable" terms,[18,22] that is, in terms of the behavior which was expected from the student. The main objectives also included minimal standards and a description of the conditions under which the behavior was to occur.

To determine minimal standards for the main cognitive objective, the pretest and posttest cases were administered to instructors and graduate students of the pedodontic and orthodontic departments from both UCLA

and UCSF Dental Schools. For each patient case a minimally acceptable score was computed by taking the average of all scores for that case. (See "Tables of Scores: Diagnosis Test (Experts)" in the Appendix.) A minimally acceptable score was computed for each case to compensate for unanticipated differences in difficulty between cases. The minimal standards for the pretest and posttest were computed by taking the average (to the nearest 10's) of the minimally acceptable scores for both cases in each test.

To clearly and concisely state the minimal standards of the main cognitive objective, it would be helpful to refer to the following diagram:

		posttest +	posttest -
pretest	+	++	+ -
	-	- +	- -

Each box in the diagram represents a different situation concerning pretest and posttest scores. The + notation indicates that the score is equal to or greater than the minimal standard set by the "experts;" the - notation indicates that the score is less. The scores from every student who completes the field test will satisfy one of the four conditions.

The product would be considered to have met its cognitive target objective if more students would satisfy the ++ or - + conditions than the + - or - - conditions.

Both the cognitive and affective general objectives were first stated during the formulation stage of the product development. When it became necessary to specify the objectives in detail, it was decided to restate the general affective objective as follows: Student attitude toward computer-assisted instruction and toward space management will not become less favorable after having taken this product. The objective is based on the assumption that this CAI product alone cannot be expected to cause substantial changes in student attitude, especially if the student is being asked to use free time to participate in the project. Moreover, it was hoped that this two-to-three-hour instructional session on the computer at least would not make the majority of the students more negative. When stated in measurable terms, the objective became: More students will not show a decrease than will show a decrease in two attitude scores obtained from a pre- and posttest questionnaire measuring attitude toward teaching method and subject matter.

DEVELOPMENT OF PRETESTS, POSTTESTS, and PROTOTYPE

Before going on to develop the main product, attention was first directed to the construction and try-out of the pretest, posttest, and prototype. It seemed advisable not to spend much time and effort on the product until there was some assurance that it could be evaluated. Similarly, a prototype of the product provided more assurance that further effort in the development would be worthwhile. It also suggested modifications to the original plans for the product.

There were two types of pretests. One pretest contained items to evaluate the student's prerequisite skills. (See "Screening Test" in the Appendix.) The second pretest measured the student's diagnostic skills. He was asked to determine whether there were space discrepancies in given patient cases and to specify treatment needs. (See "Diagnosis Test" in the Appendix.)

Of the six patient cases that were chosen for the product, two were randomly assigned to the diagnosis pretest, two to the computer practice activities, and two to the diagnosis posttest. The subject-matter specialist chose the cases, trying to keep them of equal difficulty. (See "Patient Descriptions" in the Appendix.) Slides were prepared to present the patients to the students. In order to assure that the case presentations were complete, the pretest and posttest cases were tried out on a few dental students and instructors.

In addition to these cognitive tests, there was also an affective test. It was in the form of an attitude questionnaire. (See "Attitude Questionnaire" in the Appendix.) Some items in the questionnaire were original, while others were from an extant study which involved the measurement of student attitudes toward CAI.[20] The items were changed to the future tense for the pretest and used in the past tense for the postest.

The questionnaire was divided into two parts: 1) questions concerning teaching method and 2) questions concerning subject matter. The student was asked to keep this division in mind when responding. It was hoped that this distinction would minimize the possibility that the student's attitude toward one part would affect his attitude toward the other.

Each item in the questionnaire was followed by five categories, such as 1) stongly disagree, 2) disagree, 3) uncertain, 4) agree, and 5) strongly agree. The student was directed to circle the category which most nearly represented his reaction to the item. In addition, he was given the opportunity to clarify or explain the reasons for any of his responses.

As the cognitive and affective tests were being developed, time was also being spent on the development of the prototype. The prototype involved one of the practice cases. The other practice case was not programmed for the computer until it was assured that the first case executed as proposed. The computer program was written in the PILOT[16] author language. (See "Sample of Pilot Coding" in the Appendix.) (This language is available to users at the Computing Facility of the University of California, San Francisco Medical Center.) The program was implemented on an IBM System 360 Model 50 computer. Typewriter terminals were used for input and output.

The prototype was tried-out on students and instructors. (The students were from the senior class which graduated before the field testing period.) Modifications were made according to their performance and suggestions. The majority of the modifications involved updating of computer responses to anticipated and unanticipated answers. The try-outs on the instructors pointed to the need for getting the opinions of other instructors (besides the subject-matter specialist) on the diagnoses and treatment needs of the cases. Hence, before further work was done on the development of the product, opinions from instructors from both the pedodontic and orthodontic departments were gathered. As a result, discussions on controversial points in the subject matter were included in the product.

DEVELOPMENT of MAIN PRODUCT

The most time-consuming chore in this step was the development of the interactive text. Computer responses to student answers had to be constructed for many different contingencies. The student was allowed to request diagnostic aids and to submit a diagnosis at any time during the interaction. Thus, specifying a computer response that was suppose to help the student request a diagnostic aid or correct an improper diagnosis was dependent upon which diagnostic aids the student had already requested. There were three particularly important diagnostic aids, and the diagnosis of the case was essentially the answer to the question: "Is there a space discrepancy?" There were then at least 16 possible situations when the student submitted his diagnosis. A chart which was helpful in sorting out and accounting for these 16 situations is shown in the Appendix. (See "Contingency Chart".)

In the chart, each row/column intersection represented a different situation for which a computer response had to be specified. The subject matter specialist constructed the responses on 3 x 5 cards and numbered the cards. Each row/column intersection was numbered according to the number of the corresponding computer-response card. If the same computer response was appropriate in several situations, the same number was entered in several intersections.

If a computer response involved asking the student a question, then the subject-matter specialist had to generate still more computer

responses; for each new question asked, he had to construct responses to the probable correct and incorrect answers a student might give. He also had to provide a "catchall" computer response in case a student gave an unanticipated answer. So at the bottom of each computer-response card which contained a question, he indicated the numbers of those cards which contained the computer responses that corresponded to the student's possible answers. A sample of these computer-response cards is shown in the Appendix. (See "Computer-Response Cards".)

The last row of the chart represented the situation in which the student had requested all the important diagnostic aids. Further computer responses had to be generated which would determine whether the student's diagnosis was based on an appropriate interpretation of the data. Relationships between cards became somewhat complicated, so some charts and cross-reference tables were used to help show the relationship of one computer card to another. (See "Computer-Response-Card Flow Chart", "Cross Reference Table for Computer Responses", and "Cross Reference Table for Confirmation Questions" in the Appendix.)

The computer-response cards were also used during the beginning of the development period as the medium for presenting the responses to the student. When a student entered an answer into the terminal, he was directed to read the appropriate computer-response card. This procedure proved to be a time-saver, especially since during the development, inappropriate computer responses were more frequent. If a computer response was not applicable (this could occur from program errors, unanticipated synonyms, etc.), the student did not have to wait until the computer typed the response to completion. Instead he could simply

skim through the card and then go on with the program.

The hardware used in the main product included a slide projector and tape recorder as well as the computer terminal. In conjunction with the UCLA Dental School audio-visual staff, a slide/tape synchronizer was developed for use with Kodak Carousel projectors and cassette tape recorders. To synchronize the tape, a pencil mark was placed on the appropriate spot on the tape. These synchronized slide/tape presentations were used to administer some of the remedial instruction.

As the development proceeded, the main product was periodically tried-out on students and instructors. The try-outs on the students helped the subject-matter specialist to anticipate the kinds of answers the students tended to give. These try-outs were especially useful in pointing attention to correct-answer synonyms (which were to be accepted by the computer program) and to frequently-occurring wrong answers. A sample of one of the actual student/computer interactions is shown in the Appendix. (See "Sample of Interactive Text".) The try-outs on the instructors were helpful in discerning controversial points of dentistry which needed further explaining in the product.

When the development of the main product was completed, it was made ready for presentation to the students. Administrative arrangements were made to have student subjects available for the next phase of the development.

CYCLES of TESTING and REVISION

This phase of the product development was perhaps the one which contributed the most to making this instructional product different from other teaching methods. In this step the product was continually tested and revised.

The pretests, main product, and posttests were administered to a few students. After the data for the students were collected and analyzed, modifications were made. Then the entire product was administered again to a few more students. This testing-revision cycle was repeated over a period of two months until it appeared that the minimal standards were being met.

FINAL FIELD TESTING

During the field test, the product was tried-out on a larger group of students. If minimal standards had not been met, further revision would have been necessary and the field test repeated.

Though the subject-matter specialist was on the staff of the dental school at the University of California, Los Angeles, the field test was performed at the University of California, San Francisco campus (where the instructional/computer programmer was located). Since the curricula of the two schools differed, certain arrangements had to be made to properly prepare the students for the screening test. It was important that the students be able to achieve enough of the prerequisite objectives to be ready for the CAI product. Thus, the task

analysis and list of objectives were given to the orthodontic instructor who was responsible for teaching this material to the senior students during the Fall Quarter, 1971. (A pedodontic class was not used because the pedodontic department did not have the seniors in a didactic class this particular quarter.) The orthodontic instructor agreed to model two of his lectures according to the prerequisite objectives.

During the same quarter and in the same orthodontic class, the screening test was administered. A student was considered to qualify for the field test if he reached an acceptable score on each of three parts of the screening test. (The minimal standards for these parts was determined by administering the test to several instructors and using their scores as a guide.) Those students who did not qualify were available during the product development for try-outs. The subject-matter specialist came to San Francisco to give a one-hour lecture to the field-test students. During this lecture he emphasized some of the weak points revealed by the results of the screening test.

During the Spring Quarter, 1972, the pretests, computer practice cases, and posttests were administered. The students voluntarily met as a group during one lunch hour to take the pretests. (See "Instructions to Students" in the Appendix.) At this time, they each signed up for an individual two-hour session with the computer. These computer sessions were scheduled during March and April of the Spring Quarter. Then at

the end of April, the students again met as a group for the posttests.

During the computer practice, the student was left on his own with the computer terminal, a one-page introduction (see "Introduction" in the Appendix), various other materials and equipment included in the product, and instructions where the proctor could be reached if needed.

EVALUATION

Method

It was determined whether minimally acceptable standards of the objectives were met by evaluating the students' responses on the diagnosis pretest and posttest and by studying the pretest and posttest scores on the attitude questionnaire. The score on the diagnosis test consisted of a point total from five weighted parts of the test. The five parts contained questions on diagnosis, treatment, and interpretation of three particular diagnostic aids.

The scores on the attitude questionnaire were determined by assigning a number from 1 to 5 for each response to an item (the more positive the response, the higher the number). For some items, agreement with a statement indicated a positive attitude; for others, disagreement indicated a positive attitude. The student's scores were the total over all the items for each part.

A summary report for the computer practice was based on a "keyword search" approach. In the analysis of a student's response, specific keywords (or their synonyms) that were expected to be in the anticipated correct answers were sought and tallied. In some instances, two keywords had to appear together in order to be accepted, so these keyword pairs were each counted as one. If correct keywords were missing or anticipated wrong keywords were found, the student was given some remedial text and told to modify his answer. In addition to producing a transcript of each student/computer interaction, the computer generated a summary report showing the number of correct and incorrect keywords sought and found and showing the average elapsed time for each set of responses devoted to a particular main objective.

The operation of the computer program itself was evaluated by measuring the appropriateness of the response capability of the program. Kamp[16] has described a similar method of evaluation. Briefly, all computer responses were classified as to how "good" they were. A good response was defined as one which was clearly related to the student's answer. A bad response was one which was clearly unrelated to the student's answer, since his answer was misrecognized by the program. The third category was comprised of all other computer responses, for example, those which were given to the student when his answer was unanticipated or not recognized.

Findings (See "Tables of Scores" in the Appendix)

The project period spanned 22 months (September, 1970 through June, 1972). The subject-matter specialist devoted an average of seven hours per week to the project, while the instructional/computer programmer devoted an

average of 25 hours per week. Both agreed that the single most time consuming task was the generating and updating of computer responses to student answers.

The expenses for the entire product development were approximately $30,000. Near the end of the project period, each program compilation cost on the average $18.00. The cost of the student/computer interaction averaged approximately $10.00 per hour during the field test period.

Screening Test

Of the 58 students who took the screening test, 34 qualified for the field test. In two of the three parts of the screening test there were some questions which tested enroute rather than prerequisite skills. The scores on these questions were not considered when determining whether or not a student qualified.

At the beginning of the screening test, the students were asked to rate and record their attitude toward the following question on a scale from 1 to 9 (1 being very negative, 5 neutral, and 9 very positive): "How would you evaluate your attitude towards computer-assisted instruction?" On this measure, no significant difference was found between the field test sample and the remaining students. This finding was helpful later in interpreting the results of the attitude questionnaire.

The students were also asked to record the time it took them to complete the screening test. A summary of this data and the data discussed above is reported in the "Tables of Scores: Screening Test."

Diagnosis Test

Of the 34 students who qualified, 23 students properly completed the field test. There were various reasons why 11 of the students did not properly complete the test, the most predominant being that participation in the project was voluntary and the other academic pressures on these seniors were great. (Administratively, it was not feasible to "require" students to participate.) No one, however, dropped out during the field test once having scheduled himself for a computer practice session.

As discussed earlier, in the section "Specification of Objectives", the product would be considered to have met its cognitive objective if more students would satisfy the ++ or - + conditions than the + - or - - conditions. The data in the "Tables of Scores: Diagnosis Test (Students)" can be summarized as follows:

		posttest +	posttest -
pretest	+	6	2
	-	10	5
	total	16	7

Thus, the target objective in the cognitive domain was met, since 16 students satisfied the ++ or - + conditions while only 7 students satisfied the + - or - - conditions.

The last question in the diagnosis test asked the student whether he would take responsibility for treating the case, rather than making a

referral. This question did not refer to any particular objective of the product and there is actually no right or wrong answer for these patient cases. The answer basically depends on the students background and confidence. The question was asked and the results summarized (in the "Tables of Scores: Diagnosis Test (Students)") for the sake of interest on the part of the subject-matter specialist.

Also summarized in the "Tables of Scores: Diagnosis Test (Students)" is the time it took each student to complete each case.

Attitude Questionnaire

Concerning the student attitude questionnaire, some efforts were made to assure its reliability and generalizability. First of all, approximately one-half the items came from an extant attitude questionnaire, various forms of which have had a reported reliability of .89 and .82.[20] Secondly, the entire questionnaire was run in a pilot test on eight subjects so that new items which appeared to be stated unclearly could be changed. Thirdly, a question was asked at the beginning of the screening test (see prior discussion in "Findings: Screening Test") to determine whether the field-test sample students were significantly more extreme in their attitudes toward CAI than the remaining students in the class. (If so, the generalizability of the affective findings would be limited due to the regression toward the mean.) On this measure, no significant difference was found between the field test sample and the remaining students.

The data in the "Tables of Scores: Attitude Questionnaire" indicates that, in Part 1, 12 students showed the same or an increase in attitude score between pretest and posttest, while 11 students showed a decrease. In Part

2, only 8 students showed a decrease. Thus, the affective objective was met, since at least the majority of the students did not show a more negative attitude after having had the computer practice.

Also summarized in the "Tables of Scores: Attitude Questionnaire" is the time it took each student to complete the questionnaire.

Response Capability of Program

The response capability of the program appeared to be good as is indicated by the data in the "Tables of Scores: Response Capability of Program." Out of a total of 1188 computer responses to a group of 23 students, 85 percent of the responses were categorized as good (G), 4 percent as bad (B) and 11 percent were in the category (M), which includes computer responses to misspelled answers, unanticipated answers, and so on.

There are no performance norms presently available to which these percentages can be compared. Nevertheless, when compared to Kamp's[16] results (66 percent good, 13 percent bad, and 21 percent unrecognized), this computer program seems to be operating favorably.

IMPLEMENTATION PLANS

A well-designed product can fail if the implementation is not executed properly. The implementation plans for this product took into consideration such things as "atmosphere" in the installation in which the product will be introduced in the future, availability of descriptive information or reference manuals for the product, and means of product distribution.

Since this instructional product involved a computer, it was considered important to determine whether there would be a problem in the product's future implementation because of negative attitudes toward computers. A literature search was made to find out whether other investigators have studied this problem. An instrument[17] for detecting negative attitudes was found and a way[23] to improve these attitudes was described. Mathis, et. al.,[20] have suggested that it may be possible to convert students to CAI as a method of instruction if they are given relevant programs which do not allow them to make too many errors. All in all, it seemed that this product could be received more positively if 1) the students have been previously exposed to computers, and 2) they have sufficient prerequisite skills to minimize the number of errors they will make (assuming that the program itself is of high quality and has been shown to take responsibility for achieving its objectives). Further implementation plans in the area of negative attitudes were generated into a new grant proposal[2] which aimed to develop and test another method for improving attitudes toward CAI.

A user manual which describes how to use the computer terminal is included in the product. The manual provides typing practice exercises to help the student to familiarize himself with the terminal keyboard and a "trouble sheet" to help him circumvent anticipated and unanticipated terminal-operation problems. (See "User Manual" in the Appendix.) The user manual and other documents were easily maintained and updated, since they were typed on a computer terminal using the IBM/ATS System (an adminstrative system designed for ease in document manipulations).

Plans were also made for distributing the product to other dental schools.

It was recognized that widespread distribution of the product would be dependent upon at least two major factors:

1) acceptance by other pedodontic and orthodontic departments of the space management principles used in the product, and
2) general barriers to program exchange.

To account for the first, the subject-matter specialist tried to avoid controversial principles. He tried to discern areas of disagreement and make the students aware of them. Furthermore, the detailed specifications of behavioral objectives and the task analysis were designed to be helpful in communicating to other instructors in this area.

Concerning the second factor, Denk[7] has defined at least 16 barriers to program exchange. He classifies the barriers into three major categories: 1) communication problems in exchanging programs 2) difficulties in supporting and maintaining the programs, and 3) difficulties with teacher training. He proposes as a partial solution to communication problems, the creation of a central agency whose purpose would be to publish a catalogue of curriculum materials. Denk believes that successful exchange will produce support which in turn will provide the basis for faculty training.

Of the 16 barriers, five seemed to be of more immediate concern to the successful implementation of this product. The first three relate to the publishing of information about the product. Since there is not as yet a central agency, descriptions of the product were sent to various indexes and information services, such as ENTELEK[11] and the Rochester Clearinghouse

for Self-Instructional Materials for Health Care Facilities.[6] To more directly reach the dental teachers who might be interested in the subject-matter of the product, descriptions were also sent to all dental schools in the United States. Furthermore, a condensed report describing this product development was submitted for publication.

The fourth barrier relates to a lack of documentation of many programs. The present report is expected to provide a partial solution to this barrier. Also, the computer program itself was internally documented.

Concerning the fifth barrier--lack of computer support--it should be understood that the product in its present form can be distributed only to those dental schools that have access to computer support which can accommodate the PILOT author language and typewriter terminals.

DISCUSSION

The development of this product required a teamwork approach. The instructional/computer programmer and the subject-matter specialist occasionally faced problems that stemmed from working in a team. They sometimes found themselves unable to progress to a next step because they were waiting for certain information that only the other member of the team could provide. This in part is the main reason that the project period extended 10 months beyond the initially proposed 12-month period.

Other problems of working in a team seemed not to be as difficult to overcome. Communication between the respective home bases of Los Angeles and San Francisco was effected through tie-line phone calls, occasional visits (4 or 5), and mail. As brought out earlier in this report, several different methods were used for promoting understanding in communication, such as flow charts and cross-reference tables. Prior experience[25] by the instructional/computer programmer in team development of instructional products seemed to prove useful in overcoming any serious barriers to making communications more easily understood.

The task analysis and the list of behavioral objectives proved to be useful not only as aids in the product development, but also as means for communication between the instructors from the Los Angeles and San Francisco campuses. To introduce and describe this product quickly, the list of objectives and the task analysis were often used. The instructors seemed to have no trouble comprehending the extent of the product, since the objectives were behaviorally stated and in a hierarchy.

The general attitude of the orthodontic and pedodontic instructors during the development of this product was favorable. On many occasions when they were talking to the subject-matter specialist or the instructional/computer programmer, they expressed enthusiasm in using the product itself or at least the method of instruction in their classes.

The students' attitudes were for the most part favorable during the development of the product. It was pleasing to find this to be true,

especially since dental students are usually highly pressured and yet many agreed to participate in this project. Below are a few of the comments and suggestions made by the students, either verbally or in writing:

1. "I would like to see the objectives expanded to include practice in 'how to treat,' rather than limiting the exercise to 'what needs to be treated'."
2. "I would like to have more cases on which to practice."
3. "I would be more comfortable doing only one case per session, rather than two."
4. "New approaches confuse me; certain prejudices from my training make it hard for me to learn new approaches."
5. "My background in orthodontics is weak, since there are no clinical requirements in it; I must spend most of my time satisfying those subjects which do have requirements."
6. "Because all the cases were so similar, I became bored."
7. "I would like to have a follow-up session with an instructor to help me clear up some points which are still confusing to me."

Nevertheless, it is suggested that future product development plans include means by which students be required to participate as part of a course, rather than asking them to use their free time. It probably would be a more appropriate and realistic experience for the student if this product were to replace, for example, some (but not all) of the time he spent in his seminars. Also, perhaps under these circumstances,

the more negative attitudes may have been eliminated, since the students may not have felt that this was an extra-curricular project that was further burdening their already overburdened schedules.

During the computer practice sessions, some students had questions about the dental subject matter which were not answered by or which were propagated by the computer responses. It is thus suggested that this type of practice be best combined with one or two follow-up seminars. Several students, when asked whether this combination would be suitable for them, suggested that it would be even better than their normal seminars, because they would have a chance to think through and be queried about the cases on a one-to-one basis (by the computer) beforehand. They also felt that it would save time for both the instructors and them, especially because they would not have to meet formally as a class so often.

The six patient cases in the product were chosen primarily on the basis of equal difficulty. They were then randomly assigned to pretest, practice, and posttest. Perhaps in the future, it would be advisable to follow this procedure for pretest and posttest, but for practice, it might be better to choose the cases on the basis of teaching value. This would probably make it easier to build into the program effective remedial instruction. On occasion in the present program, references to other cases had to be used, as for example, in discussing asymmetry in the arches.

When designing the development of this product, consideration was given to the variables of contamination and pretest sensitization. Little could be done to control for contamination, short of making the field test period as brief as possible and asking the students not to discuss or study this material until after the posttest. Pretest sensitization was decided not to be applicable to this situation, since the pretest is itself a part of the product; that is, it is acceptable if learning results from the pretest.

CONCLUSION

This product was designed to offer a simulation of the clinic situation, a dynamic interaction between student, instructor, and patient. Hopefully, this type of practice will better prepare the student for his clinic experiences. Furthermore, such a product may be able to help alleviate the dental teacher shortage. Though development may be initially time-consuming and expensive, it is hoped that through some sort of "boot-strapping" process, time can be made available initially for product developments so that, later, time can be freed for the instructor to tend to tasks which only he can handle.

In the future the bulk of the work involved with systematic product developments, especially in the area of CAI (since it requires knowledge of computer technology), might best be accomplished by working together with instructional product development centers.[5] Regional product development laboratories have been established by the federal government so that a coordinated attack on specific teaching problems can be

made. These products are developed with the intent that they will be useful at many institutions and can be generated without wasteful redundancy.

This regional approach could be beneficial to dental education. Dentistry has already exhibited common regional interests as, for example, in regional and national cooperation in dental licensure examinations. Many aspects of dental subject-matter are constantly changing and are controversial, and thus would not be appropriate for inclusion in expensive, regional efforts in product developments. However, there is a certain basic core of information that would remain fairly stable during a product's life-span to offset developmental costs.

It has been shown that this CAI product is a successful program--that students with the prerequisite skills who completed the product were able to achieve the objectives. Whether or not there are other instructional methods that can accomplish the same thing more economically is a question to which this project was not directed. The aim was to show that this type of product can be helpful to dental education. Hard data from student performance has verified the product's usefulness.

SUMMARY

The goal of this project was to systematically develop and field test a CAI program which would provide practice for dental students in diagnosis. The procedure that was used to develop the product is summarized in a flow chart in the Appendix. (See "Product Development Flow Chart".)

The results of the field test were favorable. The cognitive and affective objectives were achieved by the students who completed the field test.

REFERENCES

1. AFDE Offers 11 Teacher Training Fellowships. Journal of the American Dental Association, 78:287-288, February, 1969.

2. Baumrind, Sheldon and Sokolow, Sonya: Improving Attitudes Toward Computers. grant proposal submitted to National Institutes of Health and Office of Education, February, 1971.

3. Bloom, Benjamin S., Max D. Engelhart, Edward J. Furst, Walker H. Hill, and David R. Krathwohl: Taxonomy of Educational Objectives: The Classification of Educational Goals: Handbook I: Cognitive Domain. New York: McKay Company, Inc., 1956.

4. Brauer, John C. and David F. Striffler: Development of Clinical Dental Faculty: Consensus Report, Group B. Journal of Dental Education, 33:21-23, March, 1969.

5. Carpenter, C.R.: Toward A Developed Technology of Instruction--1980. In Campus 1980, Alvin C. Eurich (ed.), New York: Dell Publishing Co., Inc., 1968.

6. Clearinghouse on Self-Instruction Materials for Health Care Facilities, University of Rochester, School of Medicine and Dentistry, Rochester, NY 14627, Attn. Jerome P. Lysought.

7. Denk, J. R.: Exhange of Applications Programs for Education--A National Statement. Association for Computing Machinery: Interface, Vol. 5, No. 1, February, 1971.

8. The Dental Curriculum for 1980: Third Conference-Workshop for Dental Educators. Journal of Dental Education, 32:85-117, March, 1968.

9. Dental Teacher Shortage. Journal of the American Dental Association, 76:467-468, March, 1968.

10. Dombal, F.T., J.R. Hartley, and D.H. Sleeman: A Computer-Assisted System for Learning Clinical Diagnosis. The Lancet, 1:145-148, January 18, 1969.

11. ENTELEK Incorporated, Newburyport, Massachusetts 01950.

12. Esterhay, R.J.: CAI with the Problem Oriented Medical Record. Western Reserve University, Summer Research Progress Report, August 31, 1967, cited in Albert E. Hickey (ed): Computer-Assisted Instruction: A Survey of the Literature. Massachusetts: ENTELEK Incorporated, 1968, p. 17.

13. Gagne, Robert M. and Noel E. Paradise: Abilities and Learning Sets in Knowledge Acquisition. Psychological Monographs-General and Applied, 75: 1-18, 1961.

14. Gagne, Robert M.: The Acquisition of Knowledge. Psychological Reviews, 69: 355-365, 1962.

15. Henry, Joseph L. and Ralph E. McDonald: Development of Research Manpower for Dentistry: Consensus Report, Group A. Journal of Dental Education, 33: 17-20, March, 1969.

16. Kamp, Martin: Evaluating the Operation of Interactive Free-Response Computer Programs. Journal of Biomedical Systems, 2: 31-44, 1971.

17. Kobler, A.L. and David L. Johnson: Human Attitudes and Inhuman Computers. The Trend in Engineering, pp. 10-13, July 25, 1963.

18. Mager, Robert F.: Preparing Instructional Objectives. Palo Alto, CA: Fearon Publishers, 1962.

19. Markle, Susan M.: Empirical Testing of Programs. Programmed Instruction: Sixty-Sixth Yearbook of the National Society for the Study of Education, Chicago: University of Chicago Press, pp. 104-138, 1967.

20. Mathis, Arthur, Timothy Smith, and Duncan Hansen: College Students' Attitudes Toward Computer-Assisted Instruction. Journal of Educational Psychology, 61: 46-51, 1970.

21. Popham, James W. and Eva L. Baker: Rules for the Development of Instructional Products. Southwest Regional Laboratory for Educational Research and Development, Inglewood, CA, 1967.

22. Popham, James W.: The Teacher Empiricist. Los Angeles: Aegeus Press, 1965.

23. Rosenberg, Mervin, Marvin Reznikoff, Charles F. Stroebel, and R. Peter Ericson: Attitudes of Nursing Students Toward Computers. Nursing Outlook, 15:44-46, 1967.

24. Schorow, Mitchell: Problem-Solving Theory and the Practice of Clinical Medicine. Canadian Medical Association Journal, 97:711-716, September 16, 1967.

25. Sokolow, Sonya and William Solberg: Computer-Assisted Instruction in Dental Diagnosis: A Product Development. Journal of Dental Education, 35:349-355, June, 1971.

26. Starkweather, John A.: Computer-Assisted Learning in Medical Education. Canadian Medical Association Journal, 97: 733-738, September 16, 1967.

27. Starkweather, John A.: Computer Simulation of Psychiatric Interviewing. Proceedings of the 7th IBM Medical Symposium, 291-297, October, 1965.

28. U.S. Task Force on Health Manpower: Health Manpower. Action to Meet Community Needs. Washington, D.C.: Public Affairs Press, 1967.

29. Weizenbaum, Joseph: Contextual Understanding by Computers. Communications of the Association for Computing Machinery, 10:474-480, August, 1967.

30. Weizenbaum, Joseph: ELIZA—A Computer Program for the Study of Natural Language Communication Between Man and Machine. Communications of the Association for Computing Machinery, 9: 36-45, January, 1966.

31. Wilson, Logan: Higher Education and the National Interest in Campus 1980, Alvin C. Eurich (ed.), New York: Dell Publishing Co., Inc., 1968.

32. Woodring, Paul: The Higher Learning in America: A Reassessment. New York: McGraw-Hill Book Company, 1968.

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BEST COPY AVAILABLE

ATTITUDE QUESTIONNAIRE: FORM A

Student Name:

Date:

Time Started:

INSTRUCTIONS

To help us evaluate and revise this diagnostic practice, we would like to know how you feel about this teaching method (Computer-Assisted Instruction) and this subject matter (diagnosis of space management). When you indicate your feelings about a statement, try to keep in mind the distinction between teaching method and subject matter; that is, your feelings about one should not influence your feelings about the other. To help you keep this distinction in mind, the statements have been grouped in two parts--part 1 covers teaching method and part 2 covers subject matter. Please do not hesitate to put down exactly how you feel about each item. If you wish to clarify or explain reasons for any of your responses, please do so on the back of the last page. Your opinions will be strictly confidential.

CIRCLE THE RESPONSE THAT MOST NEARLY REPRESENTS YOUR REACTION TO EACH OF THE STATEMENTS BELOW. **RESPOND ACCORDING TO YOUR FIRST IMPRESSIONS.**

PART 1 TEACHING-METHOD STATEMENTS

1. While taking Computer-Assisted Instruction I will feel challenged to do my best work.

strongly disagree | disagree | uncertain | agree | strongly agree

2. I will be concerned that I might not be understanding the material.

strongly disagree | disagree | uncertain | agree | strongly agree

3. I will not be concerned when I miss a question because no one will be watching me anyway.

strongly disagree | disagree | uncertain | agree | strongly agree

4. While taking Computer-Assisted Instruction I will feel isolated and alone.

all of the time | most of the time | some of the time | only occasionally | never

5. I will feel uncertain as to my performance in the programmed course relative to the performance of others.

all of the time | most of the time | some of the time | only occasionally | never

6. I will find myself just trying to get through the material rather than trying to learn.

all of the time | most of the time | some of the time | only occasionally | never

7. I will know whether my answer is correct or not before I am told.

quite often | often | occasionally | seldom | very seldom

8. I will (probably) guess at the answers to questions.

quite often | often | occasionally | seldom | very seldom

9. In a situation where I am trying to learn something, it is important to me to know where I stand in relation to others.

strongly disagree | disagree | uncertain | agree | strongly agree

10. As a result of studying some material by Computer-Assisted Instruction, I will be interested in trying to find out more about the subject matter.

strongly disagree | disagree | uncertain | agree | strongly agree

11. I will be more involved in running the machine than in understanding the material.

all of the time | most of the time | some of the time | only occasionally | never

12. I feel I could work at my own pace with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

13. Computer-Assisted Instruction will make the learning too mechanical.

strongly disagree | disagree | uncertain | agree | strongly agree

14. I will feel as if I had a private tutor while on Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

15. I will be aware of efforts to suit the material specifically to me.

strongly disagree | disagree | uncertain | agree | strongly agree

16. I will find it difficult to concentrate on the course material because of the hardware.

all of the time | most of the time | some of the time | only occasionally | never

17. Questions will be asked which I feel will not be relevant to the material presented.

all of the time | most of the time | some of the time | only occasionally | never

18. Computer-Assisted Instruction is an inefficient use of the student's time.

strongly disagree | disagree | uncertain | agree | strongly agree

19. While on computer-Assisted Instruction I expect to encounter mechanical malfunctions.

very often | often | occasionally | seldom | very seldom

20. Computer-Assisted Instruction will make it possible for me to learn quickly.

strongly disagree | disagree | uncertain | agree | strongly agree

21. I will feel frustrated by the Computer-Assisted Instruction situation.

strongly disagree | disagree | uncertain | agree | strongly agree

22. The Computer-Assisted Instruction approach is inflexible.

strongly disagree | disagree | uncertain | agree | strongly agree

23. Even otherwise interesting material would be boring when presented by Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

24. In view of the effort I will put into it, I would be satisfied with what I will learn while taking Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

25. In view of the amount I will learn, I would say Computer-Assisted Instruction is superior to traditional instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

26. I would prefer taking a course by Computer-Assisted Instruction than by traditional instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

27. I am not in favor of Computer-Assisted Instruction because it is just another step toward de-personalized instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

28. Computer-Assisted Instruction will be too fast.

strongly disagree | disagree | uncertain | agree | strongly agree

29. Typing experience will be necessary in order to perform easily on Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

30. Computer-Assisted Instruction will be boring.

strongly disagree | disagree | uncertain | agree | strongly agree

31. Regardless of how I feel about this subject matter (diagnosis of space management), I will feel good about this teaching method (Computer-Assisted Instruction).

strongly disagree | disagree | uncertain | agree | strongly agree

32. I will like being able to practice diagnosis of space discrepancies with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

33. I would like to be able to practice diagnosis of other dental problems with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

34. When my diagnosis is incorrect, I feel that the Computer-Assisted Instruction will help me to correct the diagnosis.

strongly disagree | disagree | uncertain | agree | strongly agree

35. I will feel better-prepared to diagnose a case in the clinic after having had diagnostic practice with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

36. Allowing the student to make free-form responses rather than multiple-choice responses will make the diagnostic practice more realistic.

strongly disagree | disagree | uncertain | agree | strongly agree

PART 2 SUBJECT-MATTER STATEMENTS

1. Regardless of how I will feel about this teaching method (Computer-Assisted Instruction), I feel good about this subject matter (diagnosis of space management).

strongly disagree | disagree | uncertain | agree | strongly agree

2. I believe that the proper diagnosis of space discrepancies is important to the patient's dental health.

strongly disagree | disagree | uncertain | agree | strongly agree

3. I feel that practicing diagnosis of space discrepancies before entering the clinic is a waste of time.

strongly disagree | disagree | uncertain | agree | strongly agree

4. I will be interested in trying to find out more about the diagnosis of space discrepancies after this program.

strongly disagree | disagree | uncertain | agree | strongly agree

5. The current theories in the diagnosis of space discrepancies have practical value.

strongly disagree | disagree | uncertain | agree | strongly agree

6. There are too many needless formalities in the procedure for diagnosis of space discrepancies.

strongly disagree | disagree | uncertain | agree | strongly agree

7. I think that the application of cephalometric data is valuable to everyday practice.

strongly disagree | disagree | uncertain | agree | strongly agree

8. I believe the general practitioner doesn't need to use cephalometric data to adequately diagnose the treatment needs of his children's practice.

strongly disagree | disagree | uncertain | agree | strongly agree

9. The general practitioner should refer both minor and major corrective orthodontic problems to the specialist.

strongly disagree | disagree | uncertain | agree | strongly agree

10. The general practitioner should treat incipient malocclusions of all types in his practice.

strongly disagree | disagree | uncertain | agree | strongly agree

11. I believe the general practitioner can treat many minor orthodontic problems.

strongly disagree	disagree	uncertain	agree	strongly agree

12. Complete and thorough diagnosis for minor malocclusions takes too much time.

strongly disagree	disagree	uncertain	agree	strongly agree

13. I would expect to devote all of my practice to restorative procedures.

strongly disagree	disagree	uncertain	agree	strongly agree

14. I believe that the future of dental health requires that I devote considerable time to prevention techniques for my patients.

strongly disagree	disagree	uncertain	agree	strongly agree

15. I can diagnose minor malocclusion without diagnostic aids.

strongly disagree	disagree	uncertain	agree	strongly agree

16. I feel that the mixed-dentition analysis should be a routine part of a diagnostic work-up for children between the ages of 6 through 12 years.

strongly disagree	disagree	uncertain	agree	strongly agree

17. When space has been lost in the mixed-dentition period, it will generally be necessary to extract permanent bicuspid teeth.

strongly disagree	disagree	uncertain	agree	strongly agree

18. Through careful examination of available arch length, cephalometric data and an appraisal of tooth positions, I should be able to reasonably determine the needs for treatment in the mixed-dentition period.

strongly disagree	disagree	uncertain	agree	strongly agree

19. It isn't necessary to worry about permanent tooth malocclusion while the child still has deciduous teeth.

strongly disagree	disagree	uncertain	agree	strongly agree

20. I will probably not get involved in the treatment of minor malocclusion problems in children because it takes too long and isn't profitable.

strongly disagree	disagree	uncertain	agree	strongly agree

Time Completed: _____

ATTITUDE QUESTIONNAIRE: FORM B

Student Name:

Date:

Time Started:

INSTRUCTIONS

To help us evaluate and revise this diagnostic practice, we would like to know how you feel about this teaching method (Computer-Assisted Instruction) and this subject matter (diagnosis of space management). When you indicate your feelings about a statement, try to keep in mind the distinction between teaching method and subject matter; that is, your feelings about one should not influence your feelings about the other. To help you keep this distinction in mind, the statements have been grouped in two parts--part 1 covers teaching method and part 2 covers subject matter. Please do not hesitate to put down exactly how you feel about each item. If you wish to clarify or explain reasons for any of your responses, please do so on the back of the last page. Your opinions will be strictly confidential.

CIRCLE THE RESPONSE THAT MOST NEARLY REPRESENTS YOUR REACTION TO EACH OF THE STATEMENTS BELOW. **RESPOND ACCORDING TO FIRST IMPRESSIONS.**

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strongly disagree	disagree	uncertain	agree	strongly agree

2. I was concerned that I might not be understanding the material.

strongly disagree	disagree	uncertain	agree	strongly agree

3. I was not concerned when I missed a question because no one was watching me anyway.

strongly disagree	disagree	uncertain	agree	strongly agree

4. While taking Computer-Assisted Instruction I felt isolated and alone.

all of the time | most of the time | some of the time | only occasionally | never

5. I felt uncertain as to my performance in the programmed course relative to the performance of others.

all of the time | most of the time | some of the time | only occasionally | never

6. I found myself just trying to get through the material rather than trying to learn.

all of the time | most of the time | some of the time | only occasionally | never

7. I knew whether my answer was correct or not before I was told.

quite often | often | occasionally | seldom | very seldom

8. I guessed at the answers to questions.

quite often | often | occasionally | seldom | very seldom

9. In a situation where I am trying to learn something, it is important to me to know where I stand relative to others.

strongly disagree | disagree | uncertain | agree | strongly agree

10. As a result of having studied some material by Computer-Assisted Instruction, I am interested in trying to find out more about the subject matter.

strongly disagree | disagree | uncertain | agree | strongly agree

11. I was more involved in running the machine than in understanding the material.

all of the time | most of the time | some of the time | only occasionally | never

12. I felt I could work at my own pace with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

13. Computer-Assisted Instruction makes the learning too mechanical.

strongly disagree | disagree | uncertain | agree | strongly agree

14. I felt as if I had a private tutor while on Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

15. I was aware of efforts to suit the material specifically to me.

strongly disagree | disagree | uncertain | agree | strongly agree

16. I found it difficult to concentrate on the course material because of the hardware.

all of the time | most of the time | some of the time | only occasionally | never

17. Questions were asked which I felt were not relevant to the material presented.

all of the time | most of the time | some of the time | only occasionally | never

18. Computer-Assisted Instruction is an inefficient use of the student's time.

strongly disagree | disagree | uncertain | agree | strongly agree

19. While on computer-Assisted Instruction I encountered mechanical malfunctions.

very often | often | occasionally | seldom | very seldom

20. Computer-Assisted Instruction made it possible for me to learn quickly.

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21. I felt frustrated by the Computer-Assisted Instruction situation.

strongly disagree | disagree | uncertain | agree | strongly agree

22. The Computer-Assisted Instruction approach is inflexible.

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23. Even otherwise interesting material would be boring when presented by Computer-Assisted Instruction.

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26. With a course such as I took by Computer-Assisted Instruction I would prefer Computer-Assisted Instruction to traditional instruction.

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27. I am not in favor of Computer-Assisted Instruction because it is just another step toward de-personalized instruction.

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29. Typing experience is necessary in order to perform easily on Computer-Assisted Instruction.

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30. Computer-Assisted Instruction is boring.

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32. I liked being able to practice diagnosis of space discrepancies with Computer-Assisted Instruction.

strongly disagree | disagree | uncertain | agree | strongly agree

33. I would like to be able to practice diagnosis of other dental problems with Computer-Assisted Instruction.

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34. When my diagnosis was incorrect, I felt that the Computer-Assisted Instruction helped me to correct the diagnosis.

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35. I feel better-prepared to diagnose a case in the clinic after having had diagnostic practice with Computer-Assisted Instruction.

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strongly disagree | disagree | uncertain | agree | strongly agree

3. I feel that practicing diagnosis of space discrepancies before entering the clinic is a waste of time.

strongly disagree | disagree | uncertain | agree | strongly agree

4. I am interested in trying to find out more about the diagnosis of space discrepancies after this program.

strongly disagree | disagree | uncertain | agree | strongly agree

5. The current theories in the diagnosis of space discrepancies have practical value.

strongly disagree | disagree | uncertain | agree | strongly agree

6. There are too many needless formalities in the procedure for diagnosis of space discrepancies.

strongly disagree | disagree | uncertain | agree | strongly agree

7. I think that the application of cephalometric data is valuable to everyday practice.

strongly disagree | disagree | uncertain | agree | strongly agree

8. I believe the general practitioner doesn't need to use cephalometric data to adequately diagnose the treatment needs of his children's practice.

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9. The general practitioner should refer both minor and major corrective orthodontic problems to the specialist.

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10. The general practitioner should treat incipient malocclusions of all types in his practice.

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11. I believe the general practitioner can treat many minor orthodontic problems.

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13. I would expect to devote all of my practice to restorative procedures.

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14. I believe that the future of dental health requires that I devote considerable time to prevention techniques for my patients.

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17. When space has been lost in the mixed-dentition period, it will generally be necessary to extract permanent bicuspid teeth.

strongly disagree | disagree | uncertain | agree | strongly agree

18. Through careful examination of available arch length, cephalometric data and an appraisal of tooth positions, I should be able to reasonably determine the needs for treatment in the mixed-dentition period.

strongly disagree	disagree	uncertain	agree	strongly agree

19. It isn't necessary to worry about permanent tooth malocclusion while the child still has deciduous teeth.

strongly disagree	disagree	uncertain	agree	strongly agree

20. I will probably not get involved in the treatment of minor malocclusion problems in children because it takes too long and isn't profitable.

strongly disagree	disagree	uncertain	agree	strongly agree

Time Completed: _____

COGNITIVE OBJECTIVES

In this list of objectives, a lexicographic numbering system is used to show how each of the objectives are related. A lexicographic system numbers items in a hierarchy to indicate the subordinate and coordinate relations of the items; for example, an item numbered "1.3.1" is subordinate to item "1.3" but on the same level as item "1.3.2". The target and enroute objectives are labeled in parentheses after the lexicographic numbers; unlabeled objectives are prerequisite objectives.

0 (target) Without cues the student will be able to request three particular diagnostic aids (the cephalometric, model and mixed-dentition analyses) and interpret the data from these aids to determine whether arch length is adequate in the given patient cases.

0.0 (enroute) The student will recognize the contribution of data obtained from each analysis to a diagnosis of space discrepancy, and he will recognize that any one analysis alone is inadequate.

1 (enroute) The student will be able to interpret the cephalometric analysis to determine the relation of the findings to arch length.

1.1 Given examples of head films, the student will be able to label them as "Class 1", "Class 2", or "Class 3".

1.1.1 Given examples of various lateral cephalometric data, the student will demonstrate the ability to compare each with appropriate standard norm values and will be able to label the data as "Class 1", "Class 2", or "Class 3".

1.1.1.1 Given an accurate tracing of the standard bone skull outline obtained from a lateral-oriented cephalometric radiograph, the student will be able to demonstrate that he can identify a standard set of cephalometric planes and measure the angular relations produced.

1.1.1.1.1 Given a lateral-oriented cephalometric radiograph, the student will be able to identify bony landmarks.

1.1.1.1.1.1 Given a lateral-oriented cephalometric radiograph, the student will be able to trace standard boney outlines.

1.2 (enroute) The student will be able to determine that labio-lingual incisor position, as viewed from a cephalometric film, can affect arch length.

1.2.1 Given cephalometric films showing examples of incisor tooth postion, the student will be able to label each as "acceptable" or "unacceptable".

1.2.1.1 Given examples of head films, the student will be able to identify the relation of the anterior teeth.

1.2.1.1.1 Given lateral cephalometric projections showing varieties of maxillary and mandibular incisor angulations, the student will be able to measure the interincisive angular relation of each.

1.2.1.1.1.1 Given a lateral-oriented cephalometric radiograph, the student will be able to identify dental landmarks.

1.2.1.1.1.1.1 Given a lateral-oriented cephalometric radiograph, the student will be able to trace standard boney outlines.

1.2.1.1.2 Given a cephalometric tracing, the student will be able to identify and measure the labio-lingual position of the incisors relative to the basal bone.

1.2.1.1.2.1 Given a lateral-oriented cephalometric radiograph, the student will be able to identify dental landmarks.

1.2.1.1.2.1.1 Given a lateral-oriented cephalometric radiograph, the student will be able to trace standard boney outlines.

2 (enroute) The student will be able to interpret the model analysis to determine the relation of the findings to arch length.

2.1 (enroute) Given examples of adequate arch length and inadequate arch length due to tooth migration, the student will be able to determine the difference between each.

2.1.1 Given a set of dental casts, the student will be able to write a gross description of the state of occlusion. His description should include the following factors: differences between right and left sides, molar position, and cuspid position.

2.1.1.1 Given examples (models, photos, or drawings) showing different, or similar, molar and cuspid relations in antero-posterior position from a buccal view, the student will be able to discriminate the difference, or similarity, in each example.

2.1.1.1.1 Given examples of dental patterns, the student will be able to label them according to Angle's classification as "Class 1", "Class 2", "Class 3", or cusp-to-cusp.

2.1.1.1.2 Given examples of normal bucco-lingual occlusal relations and differing varieties of buccal crossbites, the student will be able to label each.

2.1.1.2 From dental photographs of children showing differing incisor relationships in occlusion, the student will be able to label each as normal (desirable), open or closed bite, protrusive or retrusive, and spaced or crowded.

2.1.1.2.1 Given photographs of children's occlusions displaying protrusive incisors (excessive overjet) and/or a closed bite (excessive overbite), normal bite, or an open bite (lack of overbite), the student will be able to label each.

2.1.1.2.1.1 Given a set of dental casts, the student will demonstrate that he can measure the overjet and overbite.

2.1.1.2.2 Given photographs of children's occlusions showing spaced or crowded incisors, the student will be able to label each.

2.1.2 (enroute) Given examples of adequate arch length and inadequate arch length due to tooth migration, the student will be able to describe the differences.

2.1.2.1 (enroute) Given a set of dental casts, the student will be able to label the casts "asymmetrical" or "symmetrical" and state the reasons for each label.

2.1.2.1.1 Given a set of dental casts, the student will be able to compare and describe the antero-posterior position of the molar and cuspid teeth.

2.1.2.1.1.1 The student will be able to discriminate between examples of dental casts displaying symmetry and asymmetry in antero-posterior positions of antimere posterior teeth.

2.1.2.1.1.1.1 Given a set of dental casts, the student will be able to measure the antero-posterior position of antimere teeth in the dental arch using a double-pointed divider, points of reference on the skeletal midline, and simple principles of geometry.

2.1.2.1.1.1.1.1 Given a set of dental casts, the student will be able to identify the median raphe, or mid palatine suture in the maxilla; mark it on the cast from front to back; and transfer this skeletal midline to the mandibular cast.

2.1.2.1.2 (enroute) Given a set of dental casts showing a bucco-lingual asymmetry, the student will be able to discriminate whether the arch has collapsed or whether it has expanded unilaterally or bilaterally.

2.1.2.1.2.1 The student will be able to discriminate between examples of dental casts showing posterior antimere teeth in symmetrical bucco-lingual position from dental casts displaying asymmetry.

2.1.2.1.2.1.1 Using a double-pointed divider on a set of dental casts, the student will be able to measure antimere teeth in their buccal position as related to the skeletal midline.

2.1.2.1.2.1.1.1 Given a set of dental casts, the student will be able to identify the median raphe, or mid palatine suture in the maxilla; mark it on the cast from front to back; and transfer this skeletal midline to the mandibular cast.

2.1.2.1.3 Given a set of dental casts, the student will be able to identify the lateral position of the incisors relative to the skeletal midline.

2.1.2.1.3.1 Given a set of dental casts, the student will be able to identify the median raphe, or mid palatine suture in the maxilla; mark it on the cast from front to back; and transfer this skeletal midline to the mandibular cast.

2.1.2.1.3.2 Given cast examples, drawings, or photographs, the student will be able to identify the maxillary and mandibular dental midlines individually and describe whether the maxillary coincides with the mandibular.

3 (enroute) The student will be able to interpret the mixed-dentition analysis to determine the relation of the findings to arch length.

3.1 The student will be able to compare the predicted size of the unerupted canine and premolar teeth with the remaining space available in the arch length.

3.1.1 Having determined incisor needs in the length of the arch, he can determine the incisor liability.

3.1.1.1 Given a set of dental casts, the student will be able to measure the incisors to determine the incisor needs in the length of the arch.

3.1.1.2 Given a set of dental casts containing permanent incisors, the student will be able to determine how much anterior space is required on each side of the skeletal midline for the central and lateral incisors.

3.1.2 Given a table of probabilities (Michigan-Moyers) and the sum of the widths of incisor teeth, the student will be able to find the predicted size of unerupted canine and premolar teeth.

3.1.2.1 Given a set of dental casts, the student will be able to measure the incisors to determine the incisor needs in the length of the arch.

3.1.2.2 Given a probability chart (Michigan-Moyers) and the sum of the widths of the four mandibular permanent incisors, the student will be able to predict the combined sizes of unerupted maxillary or mandibular cuspid and premolar teeth.

Student's answer: Yes

Computer response: Your answer seems to be based upon data obtained only from the mixed dentition analysis. This would indicate a possible misinterpretation of the data. In which arch (maxillary, mandibular, or both) do you feel there is a discrepancy?

Use 12, 13, 14

12

Student's answer: maxillary

Computer response: There is an excess of 0.5 mm on each side of the maxillary arch for a total of (+) 1.0 mm. In addition, the space between the maxillary incisors is (+) 1.9 mm. Thus, the total tooth size analysis would indicate an excess of (+) 2.9 mm available in the maxillary arch. What is responsible for your diagnosis of a space discrepancy in the maxilla?

Use 15, 16

13

Student's answer: mandibular

Computer response: When right and left side space available is compared to the space needed, an excess of (+) 0.3 mm for the total arch is found. Thus, it would appear that no space discrepancy exists on the basis of this data alone. If you agree, type ∂DA to request another diagnostic aid. If you feel there is still a space discrepancy in the mandible what do you feel is the reason?

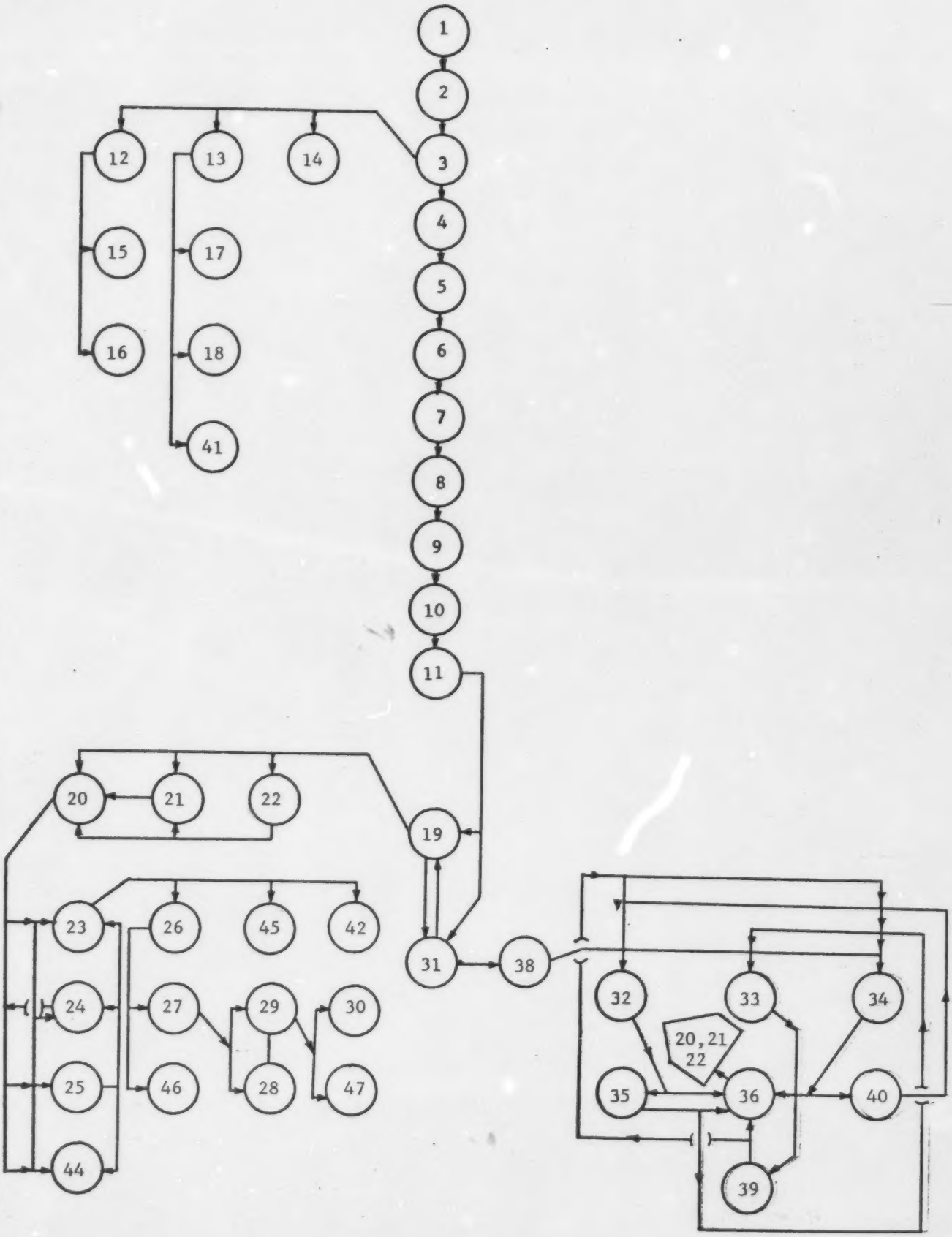
Use 17, 18

15

Student's answer: incisors (protruded, spaced)

Computer answer: The maxillary incisors appear to be protrusive and spaced with a lack of incisal contact with the mandibular incisors. However, the excess of (+) 2.9 mm of arch length in the maxilla might provide for incisor retraction and still provide enough room for the erupting 3,4,5. You are expected to confirm or deny this possibility. Type ∂DA to request a diagnostic aid that would allow you to do so.

COMPUTER-RESPONSE-CARD FLOW CHART



Question: Is there a space discrepancy?

CONTINGENCY CHART

DIAGNOSTIC AIDS ALREADY REQUESTED BY STUDENT (1 = requested)			OUR RESPONSE TO STUDENT	
			STUDENT GAVE CORRECT ANSWER	STUDENT GAVE INCORRECT ANSWER
CEPH	MODEL	MIXED-DENT		
0	0	0	1	1
0	0	1	2	3
0	1	0	4	5
0	1	1	6	7
1	0	0	8	8
1	0	1	9	10
1	1	0	11	11
1	1	1	19	31

CROSS REFERENCE TABLE FOR COMPUTER RESPONSES

CARD NUMBER	STUDENT'S ANSWER	CARDS USED
1	no or yes (000)	
2	no (001)	
3	yes (001)	
4	no (010)	
5	yes (010)	12,13,14
6	no (011)	
7	yes (011)	
8	no or yes (100)	
9	no (101)	
10	yes (101)	
11	no or yes (110)	
12	maxillary	15,16
13	mandibular	17,18,41
14	both	
15	incisors spaced	
16	catchall	
17	incisors crowded	
18	incisors shifted	
19	no (111)	20,53,54,56
20	class 1	21,52
21	symmetrical	43,51,55
22	yes	23,24,25,44
23	incisors shifted	26,45,42
24	incisors collapsed	23,25,44
25	molars drifted	23,24,44
26	model analysis	27,46
27	cephalometric analysis	28,29
28	catchall	29
29	diastema	30,47
30	model anal. or ceph. anal.	
31	yes (111)	19,38
32	mixed-dentition analysis	35,36
33	model analysis	36,30
34	cephalometric analysis	36,40
35	no	36,33,34
36	yes	19
37	yes	32,33,34
38	yes	37,32,33,34
39	no	36,32,34
40	no	32,33
41	catchall	
42	cephalometric analysis	26
43	class I	48,50
44	catchall	23
45	mixed-dentition analysis	26,42
46	mixed-dent. anal. or model anal.	27
47	mixed-dentition analysis	30

CROSS REFERENCE TABLE FOR CONFIRMATION QUESTIONS

CARD	QUESTION ASKED	CARDS USED
19	What Angle classification of the molar relationship do the dental casts show?	20,53,54,56
20	Does the model analysis show the upper and lower molars to be symmetrical or asymmetrical?	21,52
21	Does the cephalometric data show a Class 1, Class 2, or Class 3 relationship?	43,51,55
22	Though the difference between right and left sides is slight, how do you account for the difference?	23,24,25,44
23	Which diagnostic aid helped you to determine that mesial drift had not occured?	26,45,42
26	Which diagnostic aid did you use to determine that the mandibular incisors were in an acceptable labio-lingual position relative to the basal bone?	27,46
27	Where was the additional space or (+) 1.9 mm in the maxillary arch?	28,29
29	Which diagnostic aid indicates you might possibly be able to retract these teeth without a problem resulting?	30,47
48	Was the predicted size of the unerupted canine and premolar teeth less than the remaining space available in the "maxilla"?	57,58
57	Does the mixed-dentition analysis show that the mandibular total arch length was adequate for the unerupted teeth?	22,49

DIAGNOSIS TEST

Student Name:

Date:

Time Started:

INSTRUCTIONS: Fill in the answers to the following questions according to your interpretation of the diagnostic data provided. Please keep your answers confidential.

1. Is there a space discrepancy now?

2. If there is a space discrepancy, would it have to be resolved through changes in tooth position, as opposed to eventual extraction of permanent teeth? If no, explain.

3. According to the cephalometric analysis, classify the skeletal pattern.

4. According to the cephalometric analysis, does the labio-lingual position of the incisors in this case have an effect to decrease arch length?

5. According to the cephalometric analysis, do the incisors occlude in an "acceptable" relation for the skeletal pattern?

6. According to the cephalometric analysis, is the labio-lingual position of the incisors relatively normal in the maxilla? If not, describe.

In the mandible?

7. From the model analysis, describe the occlusion or classify the relation of the following teeth.

Incisors. **(Describe the occlusion)**

Cuspids -- right. **(Classify)**

Cuspids -- left. **(Classify)**

Molars -- right. **(Classify)**

Molars -- left. **(Classify)**

8. According to the model analysis, is there any significant asymmetry present in the maxilla affecting arch length? If so, what teeth are involved?

In the mandible?

9. According to the symmetrical appraisal of the models, was there any significant dental collapse to the lingual or expansion to the buccal either unilaterally or bilaterally in the maxillary arch? If yes, which?

the mandibular arch?

10. From the model analysis, does the incisor midline coincide with the skeletal midline in the maxilla? If not, describe the deviation.

In the mandible?

11. According to the mixed-dentition analysis, is the predicted size of the unerupted canine and premolar teeth presently greater than the remaining space available in the maxilla?

In the mandible?

12. From the mixed-dentition analysis, is there a need to gain arch length in the maxilla?

In the mandible?

13. What are the present treatment needs in the maxilla? (Assume there are no limits on time or money and don't concern yourself with how the treatment should be performed.)

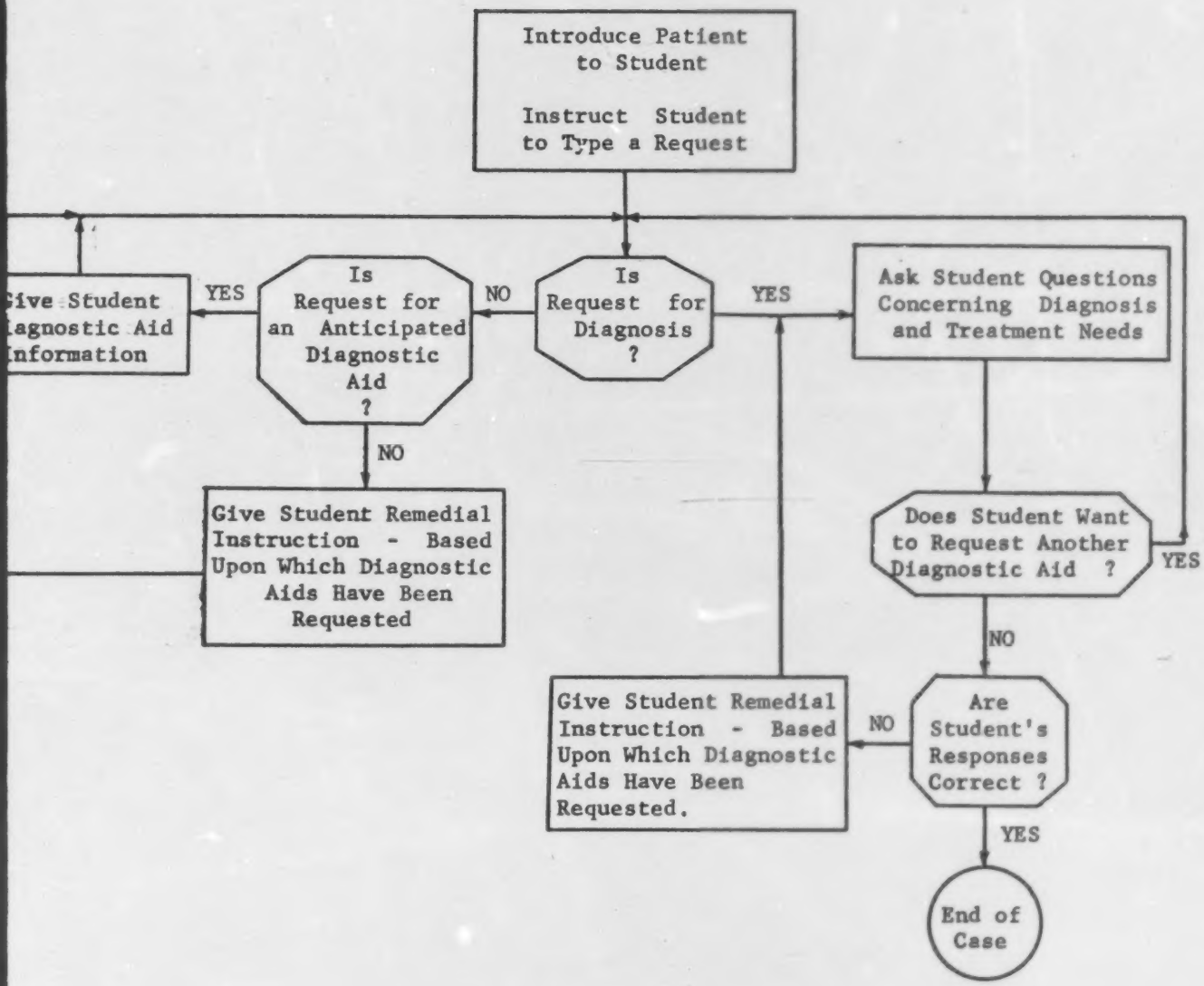
In the mandible?

14. As a general practitioner, would you take responsibility for the management of this patient's treatment needs in space management?

Time Completed: _____

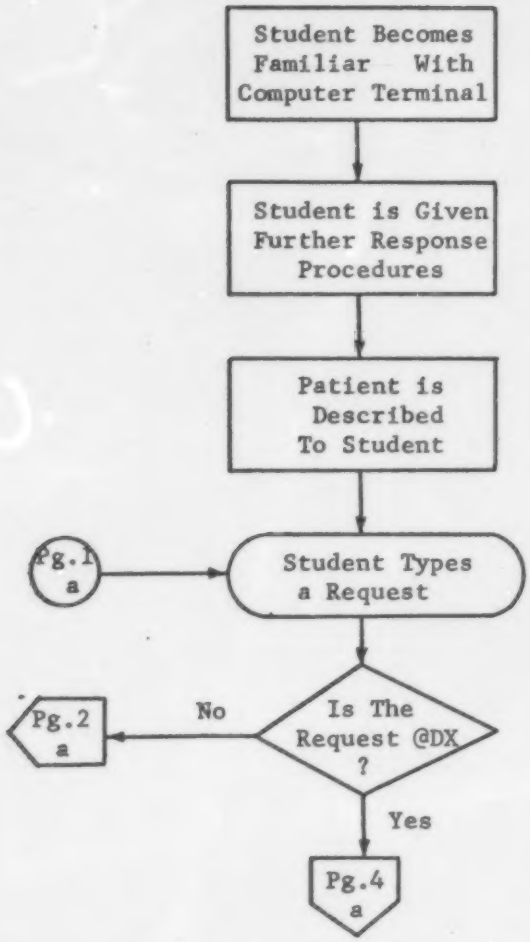
FLOW CHART OF THE INTERACTION

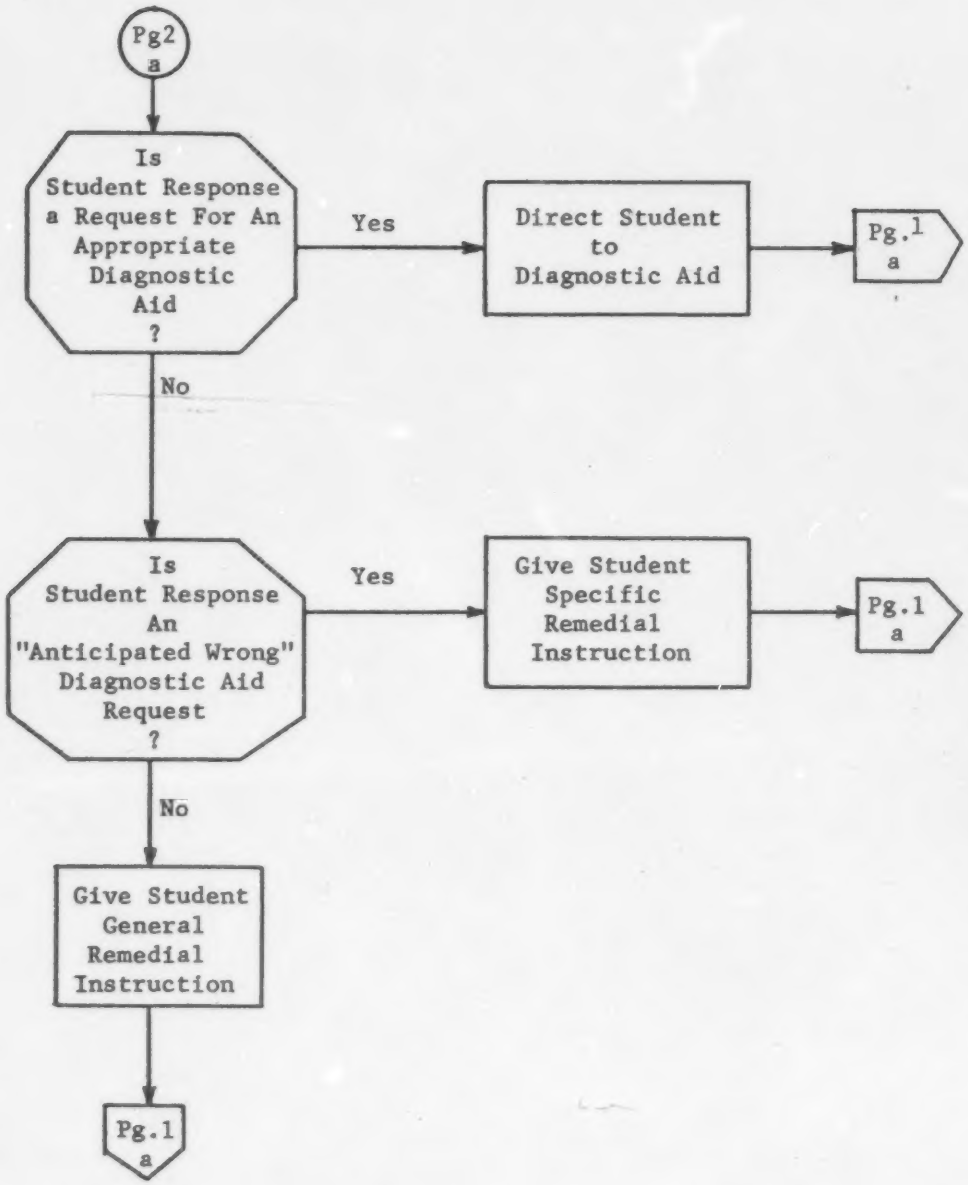
GENERAL

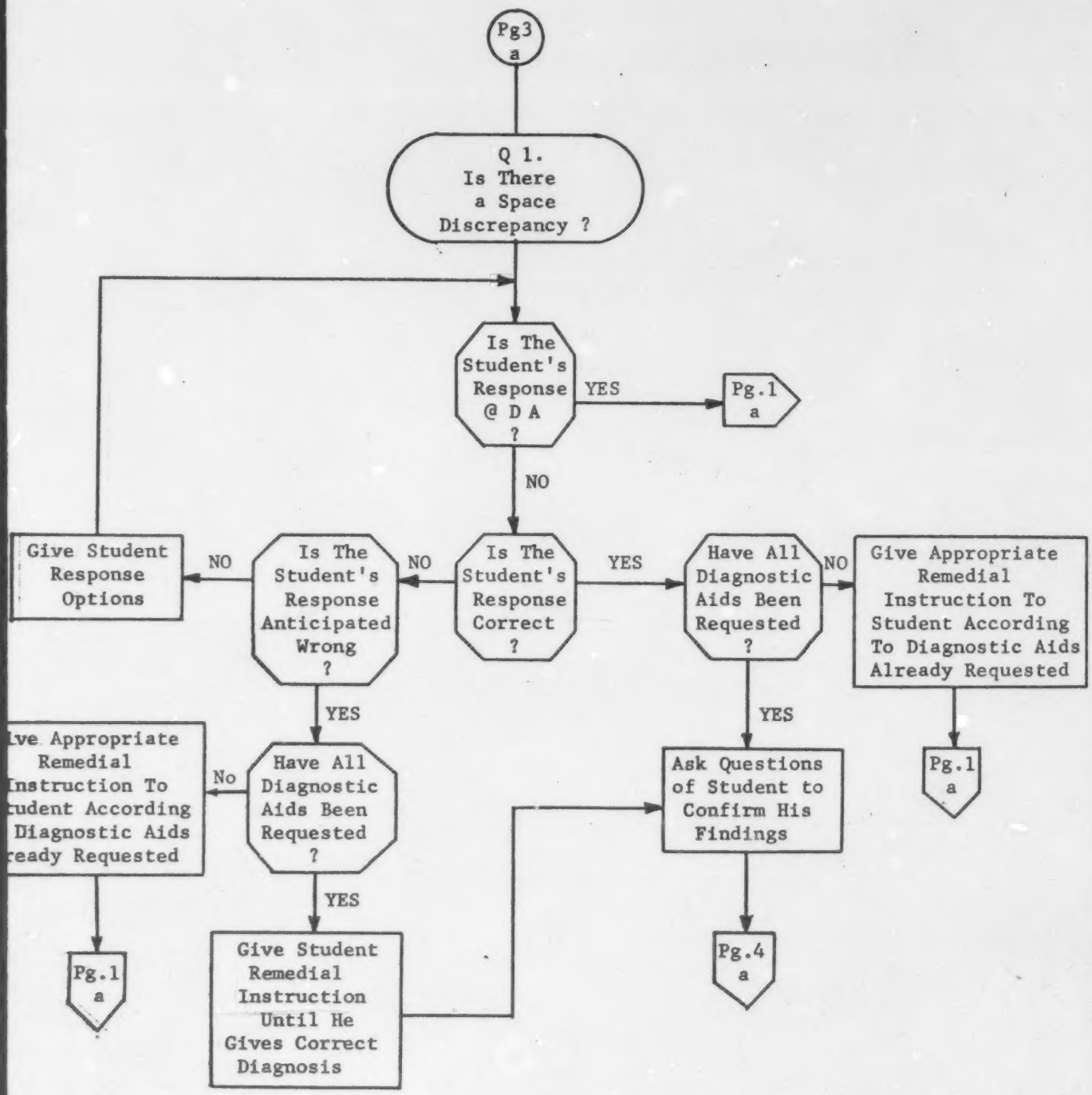

Introduce Patient to Student
Instruct Student to Type a Request
Is Request for Diagnosis ?
YES
Ask Student Questions Concerning Diagnosis and Treatment Needs
NO
Is Request for an Anticipated Diagnostic Aid ?
YES
Give Student Diagnostic Aid Information
NO
Give Student Remedial Instruction - Based Upon Which Diagnostic Aids Have Been Requested
Does Student Want to Request Another Diagnostic Aid ?
YES
NO
Are Student's Responses Correct ?
NO
Give Student Remedial Instruction - Based Upon Which Diagnostic Aids Have Been Requested.
YES
End of Case

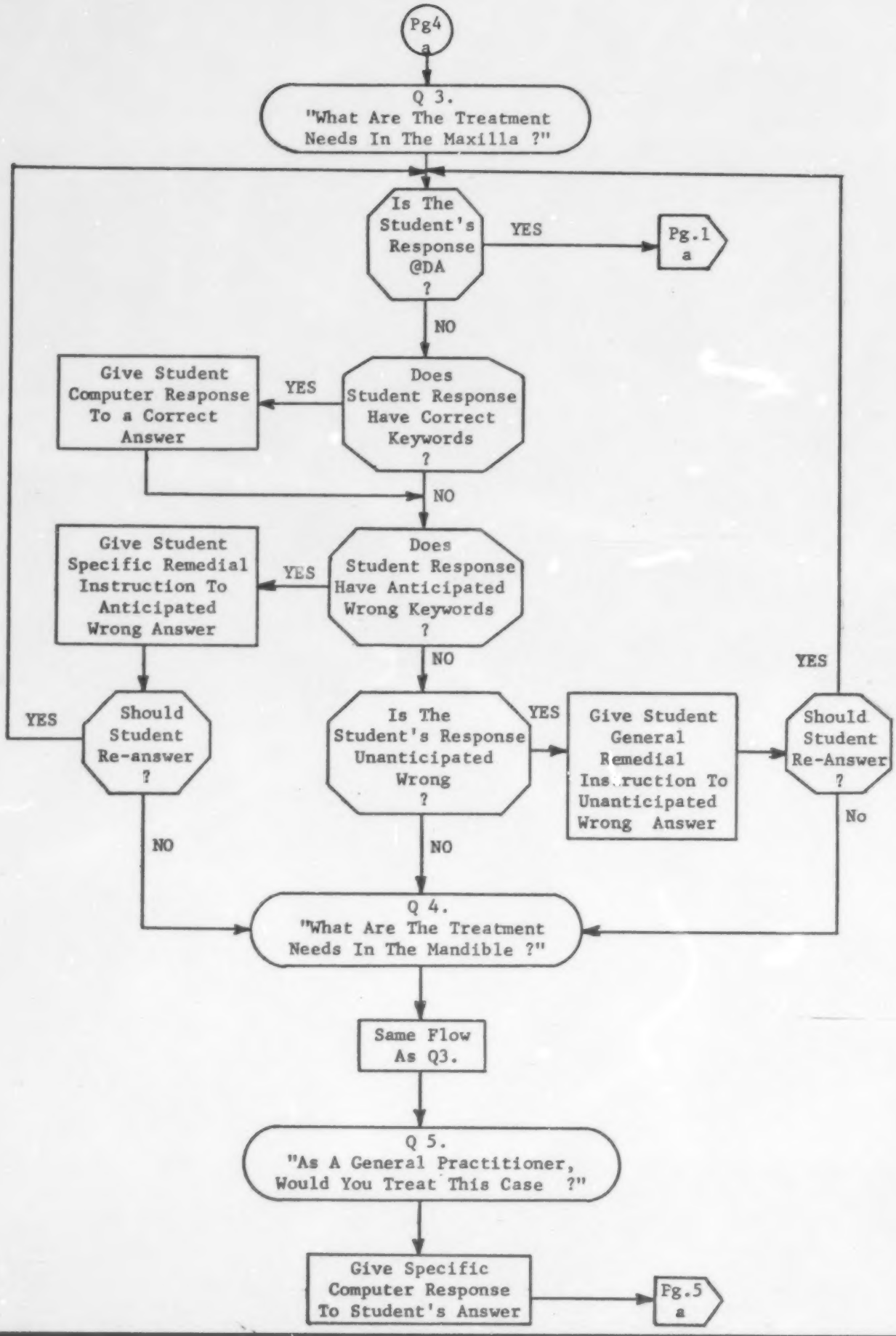
FLOW CHART OF THE INTERACTION

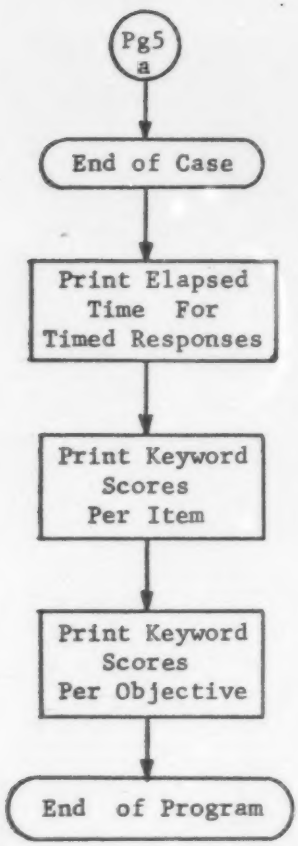
DETAILED




Pg2
a
Is
Student Response
a Request For An
Appropriate
Diagnostic
Aid
?
Yes
Direct Student
to
Diagnostic Aid
Pg.1
a
No
Is
Student Response
An
"Anticipated Wrong"
Diagnostic Aid
Request
?
Yes
Give Student
Specific
Remedial
Instruction
Pg.1
a
No
Give Student
General
Remedial
Instruction
Pg.1
a


Pg3 a
Q 1. Is There a Space Discrepancy ?
Is The Student's Response @ D A ?
YES
Pg.1 a
NO
Is The Student's Response Correct ?
YES
Have All Diagnostic Aids Been Requested ?
NO
Give Appropriate Remedial Instruction To Student According To Diagnostic Aids Already Requested
Pg.1 a
YES
Ask Questions of Student to Confirm His Findings
Pg.4 a
NO
Is The Student's Response Anticipated Wrong ?
NO
Give Student Response Options
YES
Have All Diagnostic Aids Been Requested ?
No
lve Appropriate Remedial Instruction To tudent According Diagnostic Aids eady Requested
Pg.1 a
YES
Give Student Remedial Instruction Until He Gives Correct Diagnosis


Pg4
a
Q 3.
"What Are The Treatment Needs In The Maxilla ?"
Is The Student's Response @DA ?
YES
Pg.1
a
NO
Does Student Response Have Correct Keywords ?
YES
Give Student Computer Response To a Correct Answer
NO
Does Student Response Have Anticipated Wrong Keywords ?
YES
Give Student Specific Remedial Instruction To Anticipated Wrong Answer
NO
Is The Student's Response Unanticipated Wrong ?
YES
Give Student General Remedial Instruction To Unanticipated Wrong Answer
Should Student Re-Answer ?
YES
No
Should Student Re-answer ?
YES
NO
NO
Q 4.
"What Are The Treatment Needs In The Mandible ?"
Same Flow As Q3.
Q 5.
"As A General Practitioner, Would You Treat This Case ?"
Give Specific Computer Response To Student's Answer
Pg.5
a


Pg5
a
End of Case
Print Elapsed
Time For
Timed Responses
Print Keyword
Scores
Per Item
Print Keyword
Scores
Per Objective
End of Program

INSTRUCTIONS TO STUDENT

This computer-assisted instruction project has been designed to provide the student with practice in diagnosing space management cases in pediatric dentistry. A computerized practice exercise of this sort is not meant to replace the clinic experience. Instead, it is hoped that this exercise will help the student prepare for his encounter with the patient. Though it may be preferable to have this type of practice in a seminar situation with a human instructor instead of a machine, the teacher shortage in dental education has made this alternative impractical. This project is an attempt to develop an effective instructional method which allows a dialogue between the student and instructor without requiring the presence of the instructor. Thus, valuable time is saved for the instructor.

The product is being tested on students to give the authors the opportunity to measure the effectiveness of the practice. Whether or not this is an efficient method of teaching, in terms of cost, is another question. At present computer costs are high, but they seem to be steadily decreasing. If costs continue to decrease and if this product proves effective, then it could become a valuable teaching aid in dental education.

You are asked to follow the procedure described below, without requesting aid from anyone except the person who has been designated as "proctor." Thank you for your time and cooperation.

1. Complete a "Diagnosis Test" form for Case #2 and Case #5.

2. Complete the "Attitude Questionnaire: Form A".

3. Check to make sure that all items have been completed in the Attitude Questionnaire and in the Diagnosis Tests. Give them to the proctor.

4. Designate the time in the chart on the table during which you will be able to take the computer practice. Write your last name next to the appropriate time and day in the chart.

5. Please do not discuss this material or study similar material until after our second lunch-time meeting. (At this meeting, your scored screening tests from last quarter will be returned to you.)

6. Please be reliable and prompt to your computer-practice appointment. Your attendance is very important. If there are any problems, contact Sonya at 666-4414 or 665-0469.

INTRODUCTION

This introduction will present to you the method by which you are to interact with the computer terminal while you are preparing your diagnoses. The User Manual describes in detail the procedure by which you are to enter messages to the computer. Remember that 1) you can construct your responses using your own words, but please do not use abbreviations, 2) you must press the RETURN key to enter the response into the computer, and 3) there will be a variable amount of delay before the computer responds to your messages. The variable delay may be due to several reasons, one of which is that the computer may be handling many terminals such as yours, so you are sharing its attention with other users. If the delay is more than 3 minutes, check the TROUBLE SHEET in the "Appendix" of the User Manual for further instructions. Incidently, occasionally the operators at the computing facility will send a message to your terminal such as "The system will go down at 12 noon." If you are confused by any of these messages or by any other aspect of the computer operation, please call the proctor or the computing facility at the numbers indicated in the TROUBLE SHEET.

In this exercise you will be asked to submit diagnoses and specify treatment needs for two possible space discrepancy cases. To prepare your diagnoses you are free to request from the computer any diagnostic aids which you would also have available in the clinic. If your request is unanticipated or inappropriate, you will be given further instructions by the computer. If your request is deemed important, the data will either be transmitted to you on the typewriter or you will be directed to a container on the table beside the typewriter. You will not be required to perform the analyses you request, only to interpret them. Nevertheless, if you wish to check any of the data, certain instruments have been made available to you on the table in an envelope labeled "INSTRUMENTS".

When you are ready to submit a diagnosis, you should signal the computer by entering an @ sign followed by the letters DX. (The @ sign is the right-most key in the third row from the bottom of the typewriter.) For example, let's assume that after having requested to see the chart and the x-rays of the patient, you feel ready to submit a diagnosis. You should then enter @DX and wait for the computer to respond. Let's say that you had not yet requested all the important diagnostic aids. The computer consequently would direct you to request further data before submitting your diagnosis. (To be able to make further diagnostic-aid requests, you would be directed to enter @DA and then wait for the computer to ask for your request.)

These instructions will be summarized for you on the computer terminal.

PATIENT DESCRIPTION: CASE #1

This patient is a ten and a half year old Caucasian girl of average stature and good health. Her facial characteristics in profile are relatively Class 1, yet her resting lip posture is flaccid or loose. At rest, her lips are parted with the upper lip appearing to be slightly short. The lower lip is adequate and together her lips seem full and procumbent. Upon swallowing, her lower lip curls slightly under the upper incisors, but this is not an abnormal mentalis habit, lip or swallowing pattern. On frontal view, her facial characteristics are symmetrical.

PATIENT DESCRIPTION: CASE #2

This is an eight year three month old Caucasian girl of average stature and good health. She has no unusual medical or dental history. Her facial features both in profile and frontal view, appear in balance and symmetrical. The profile view displays a Class I appearance. She keeps her lips parted in rest position with no evidence of a breathing or swallowing habit. The upper lip may be slightly short and muscular; tone is good.

Dental examination shows a mixed dentition with three missing deciduous molars: both mandibular second deciduous molars and the upper right first deciduous molar.

PATIENT DESCRIPTION: CASE #3

This eight year and six month old Caucasian girl presents a physical history of average and continuous good health. Her stature is consistent with her age, but she might be regarded as slight of build and moderately below the mean values of physical stature for her age.

Her facial features are symmetrical when viewed from in front and her profile features are in good Class I balance. Her features could be described as somewhat petite. She has no history of oral habits including no evidence of excessive tongue or lip action during swallowing or at rest.

PATIENT DESCRIPTION: CASE #4

This patient is an eight year ten month Caucasian boy of average stature and good health. Examination of his facial features displays a Class I profile and symmetrical facial features from frontal view. The upper lip appears somewhat short, but has good tone. There is no evidence of oral habits..

PATIENT DESCRIPTION: CASE #5

This eight year and nine month old Caucasian boy displays an average physical stature and a history of continuous good health. His facial features are generally symmetrical from a frontal view while his lips are full-bodied from both a frontal and profile view. Both lips appear somewhat shortened and, in a relaxed posture, he appears to be a very mild mouthbreather. The lower lip curls labialward a bit more than is usual for this age but appears to relate to the closed bite evidenced in his occlusion.

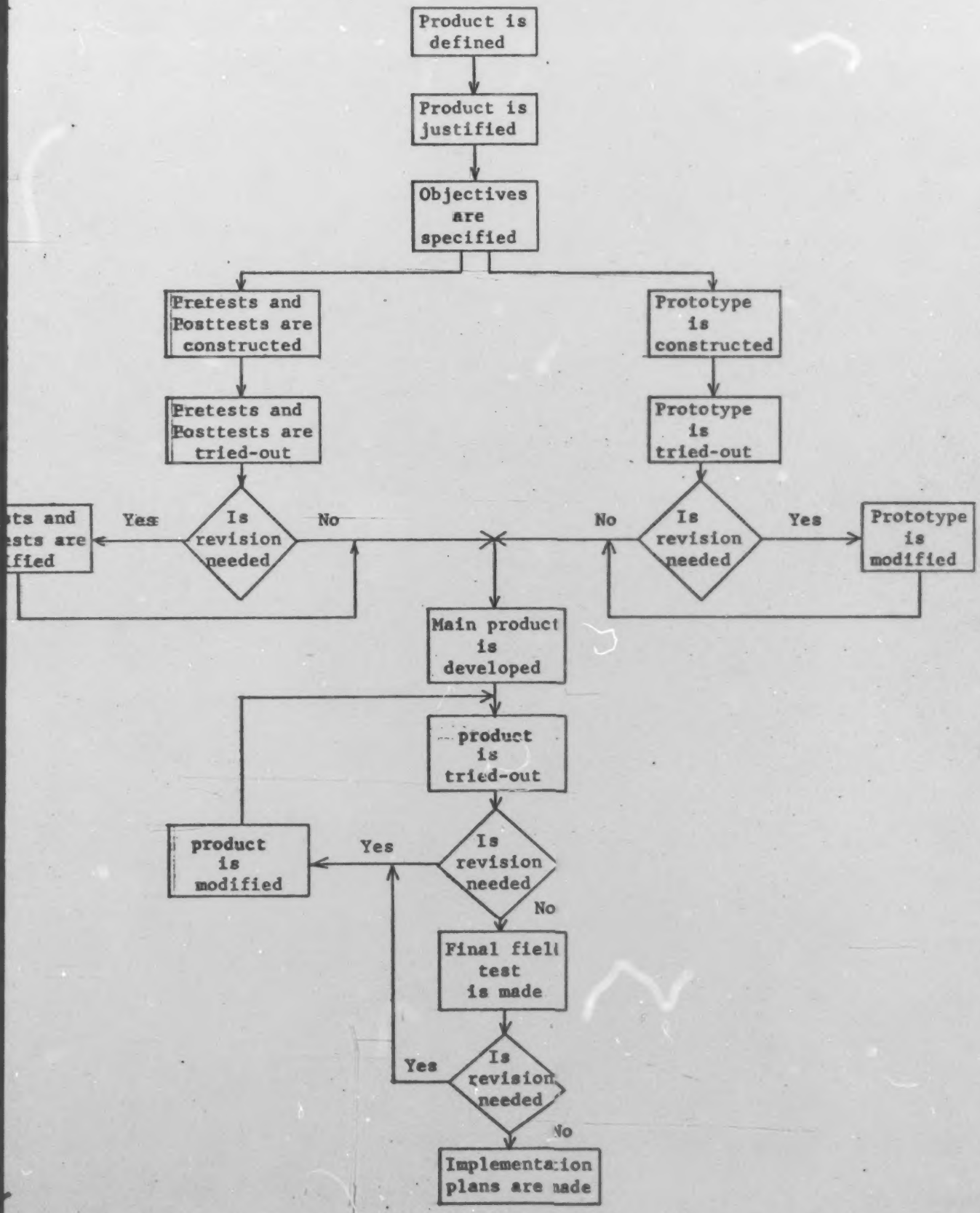
No clinical impression would lead the examiner to suspect any oral habit pattern. There is no evidence of either a lip or mentalis habit.

PATIENT DESCRIPTION: CASE #6

This patient is an eight year eight month old healthy and normally statured Caucasian boy. His facial appearance is relatively Class I in profile view and he displays a prominent upper lip because of a protrusive incisor. His lips are of acceptable length and tone and there is an absence of all oral habits.

From a frontal full-face view his right and left facial sides are in balance symmetrically. In checking the midline relation of his teeth to his face, it can be noted that both dental midlines deviate to the right side of a mid-face plane (bridge of nose, filtrum of upper lips, and chin dimple) with the lower deviating more than the upper.

PRODUCT-DEVELOPMENT FLOW CHART



Sample of Interactive Text (Actual Student)

```
05D - UCSF TELEPROCESSING
SELECT PROCESSOR OR TYPE ? FOR HELP
pilot
WHAT IS YOUR NAME?  sonya
WHAT IS YOUR ACCOUNT NUMBER?  1084
PILOT 1.5 -  8:17:38 PM, THURSDAY MARCH 16, 1972

THIS IS THE PILOT MONITOR
ENTER REQUESTS OR "?" FOR HELP

.start case1

PASSWORD?

.lacy

YOUR RESTART NUMBER IS '113'
REQUEST: START 'CASE1' WITH PASSWORD 'LACY' AND RESTART NUMBER '113'
CORRECT?

.yes

OK
:PRACTICE CASE 1;                    23:17  03/06/72  COMP-B3  EXEC-

ENTER THE NUMBER 0 TO BEGIN UNLESS YOU HAVE BEEN DIRECTED TO USE THE
SKIP OPTION.

.0

THIS INSTRUCTIONAL PROGRAM WILL PROVIDE PRACTICE IN DIAGNOSING SPACE
MANAGEMENT CASES IN PEDIATRIC DENTISTRY.  SPECIAL EMPHASIS WILL BE
PLACED ON THE UTILIZATION AND INTERPRETATION OF THREE PARTICULAR
DIAGNOSTIC AIDS.

WE HOPE THAT THIS PRACTICE WILL BETTER PREPARE YOU FOR YOUR ACTUAL
CLINIC ENCOUNTERS.  BY NO MEANS IS IT MEANT TO REPLACE THESE
ENCOUNTERS.

VARIOUS MEDIA WILL BE USED TO PRESENT DATA AND RESPONSES TO YOU.  YOU
MAY BE DIRECTED TO USE THE SLIDE PROJECTOR, TAPE RECORDER, OR OTHER
MATERIALS ON THE TABLE.

PLEASE TYPE YOUR LAST NAME AND PRESS RETURN.

.lacy

NOW, DR. LACY, IMAGINE YOURSELF IN THE PEDODONTIC CLINIC, STANDING
NEXT TO YOUR PATIENT WHO IS SITTING IN THE DENTAL CHAIR.  YOUR
INSTRUCTOR (VIA THE COMPUTER TERMINAL) IS ALSO NEARBY TO HELP YOU IF
YOU HAVE ANY TROUBLE AND TO LET YOU KNOW IF YOU HAVE DONE WELL.

READ THE INTRODUCTION AND THE PATIENT DESCRIPTION FOR CASE 1.
 THEN PRESS RETURN TO GO ON.

.
```

WHEN THE COMPUTER TYPES "REQUEST?", ENTER THE NAME OF A DIAGNOSTIC AID. YOU SHOULD REQUEST ONLY ONE AID AT A TIME.

WHEN YOU FEEL THAT YOU HAVE REQUESTED ALL THE NECESSARY DIAGNOSTIC AIDS, ENTER ONLY THE CHARACTERS @DX THE NEXT TIME THE COMPUTER ASKS FOR YOUR REQUEST. THEN WAIT FOR THE COMPUTER TO POSE QUESTIONS ABOUT DIAGNOSIS AND TREATMENT.

FEEL FREE TO REFER TO THIS SUMMARY AT ANY TIME DURING THE PROGRAM.

REQUEST?

.x-ray

ONE KIND OF X-RAY IS ESPECIALLY IMPORTANT FOR THIS DIAGNOSIS--THE X-RAY WHICH SHOWS THE PATTERN OF SKELETAL JAW GROWTH. YOU SHOULD REQUEST, BY AN ACCEPTED NAME, THIS PARTICULAR X-RAY.

REQUEST?

.cephalometric head film

THE CEPHALOMETRIC FILM, TRACING, AND ANALYSIS ARE IN ENVELOPE 1.1.

REQUEST?

.study casts

THE STUDY CASTS ARE IN BOX 1.1. ALSO, SLIDES 6 THROUGH 26 ILLUSTRATE A MODEL ANALYSIS WHICH PROVIDES THE OPPORTUNITY TO APPRAISE THE SYMMETRICAL POSITION OF TEETH IN EACH ARCH. (WHEN MEASURING THE SAME TOOTH IN THE OPPOSITE SIDE, THE DISTANCE BETWEEN THE LEGS OF THE DIVIDERS IS KEPT CONSTANT.)

REQUEST?

.arch length analysis, using Michigan-Moyers prediction chart

THE COMPLETED MIXED-DENTITION ANALYSIS OF BOTH THE UPPER AND LOWER ARCHES IS IN ENVELOPE 1.3. (INCISOR LIABILITY HAS BEEN TAKEN INTO ACCOUNT IN THIS DATA.)

REQUEST?

.photographs of patient, head and profile

UNFORTUNATELY, THE FACIAL PHOTOGRAPHS ARE NOT AVAILABLE. FOR THE PURPOSES OF THIS EXERCISE, PLEASE ACCEPT THAT THE FACIAL PROFILE IS QUITE NORMAL, GIVING NO EVIDENCE OF ABNORMAL MUSCULAR PATTERN. OTHER THAN THE UPPER LIP BEING SLIGHTLY SHORT, LIP LEVELS, TONUS, AND SO ON ARE ACCEPTABLE. (THE SOFT TISSUE OUTLINE CAN BE SEEN ON THE CEPHALOMETRIC TRACING.)

REQUEST?

.medical and dental histories

THIS TEN AND ONE-HALF YEAR OLD GIRL PRESENTS A NORMAL DENTAL AND MEDICAL HISTORY IN ALL ASPECTS FOR HER AGE AND STAGE OF DEVELOPMENT. THROUGH PRIOR EXAMINATION IT HAS BEEN CONFIRMED THAT THERE IS NO EVIDENCE OF ORAL HABITS OR OF EXTRINSIC FACTORS HAVING BEARING ON HER OCCLUSION. SHE HAS EXPERIENCED MILD CARIES AND HAS HAD CONTINUAL [illegible] RECORDS AVAILABLE FOR

REQUEST?

.@DX

IS THE SPACE AVAILABLE IN THE TOTAL ARCH SUFFICIENT TO ACCOMMODATE ALL THE ERUPTING PERMANENT TEETH?

.yes

YOUR ANSWER IS CORRECT. YOU HAVE REQUESTED THE MODEL, CEPHALOMETRIC, AND MIXED-DENTITION ANALYSES. LET'S SEE HOW YOU INTERPRETED THE DATA AND DREW CONCLUSIONS. CONSIDER THE MODEL ANALYSIS FIRST. THE MAXILLARY INCISORS ARE PROTRUSIVE AND SPACED. THERE IS A CROWDING IN THE MANDIBULAR INCISOR SEGMENT. WHAT ANGLE CLASSIFICATION OF THE MOLAR RELATIONSHIP DO THE DENTAL CASTS SHOW?

.class I

CORRECT. THE DENTAL CASTS SHOW A BILATERAL CLASS I RELATION. DOES THE MODEL ANALYSIS SHOW THE UPPER AND LOWER MOLARS TO BE SYMMETRICAL OR ASYMMETRICAL FROM LATERAL AND OCCLUSAL VIEWS?

.symmetrical

YES. THE DENTAL CASTS SHOW NEAR SYMMETRICAL MOLAR POSITION IN BOTH ARCHES.
WOULD YOU LIKE TO VIEW A FEW EXAMPLES OF ASYMMETRY IN ANOTHER CASE?

.yes

REFERRING TO SLIDE 34, THE DIVIDER HAS BEEN ADJUSTED TO COINCIDE WITH THE MESIAL SURFACE OF THE LEFT MOLAR. SLIDE 35 SHOWS THE ROTATION OF THE DIVIDER TO THE MOLAR ON THE OPPOSITE SIDE. THE WIDTH OF THE DIVIDER HAS NOT BEEN CHANGED, AND YOU WILL NOTE THAT THE MOLAR IN THE SECOND SLIDE IS ASYMMETRICAL. THUS, THE MOLARS ARE ASYMMETRICAL ANTERO-POSTERIORLY. IN SLIDES 36 AND 37, THE DECIDUOUS CUSPIDS SHOW AN ANTERO-POSTERIOR ASYMMETRY THAT IS QUITE LARGE, MORE THAN HALF THE TOOTH.
WOULD YOU LIKE TO SEE AN EXAMPLE OF A POSSIBLE COLLAPSE OR EXPANSION DUE TO A BUCCO-LINGUAL ASYMMETRY?

.yes, both

SLIDES 38 AND 39 SHOW THE SAME DECIDUOUS CUSPID AS MEASURED BY BUCCO-LINGUAL ASYMMETRY. BUCCO-LINGUAL ASYMMETRIES SHOULD LEAD US TO CONSIDER THAT A BUCCAL OR LINGUAL EXPANSION OR COLLAPSE MAY HAVE OCCURRED. THE AMOUNT OF THE ASYMMETRY SHOWN IN SLIDES 38 AND 39 IS MODERATE. SMALL AMOUNTS OF ASYMMETRY SHOULD LEAD US TO QUESTION ITS EFFECT ON LOSSES IN ARCH LENGTH.
ORDINARILY THE LATERAL CEPHALOMETRIC FILM IS USED TO CONFIRM OR REFUTE THE IMPRESSION GAINED FROM THE MODEL AND MIXED-DENTITION ANALYSES. DOES THE CEPHALOMETRIC DATA SHOW A CLASS I, CLASS II, OR CLASS III SKELETAL RELATIONSHIP IN CASE 1?

.class I, with possible class II tendency

CORRECT. THE SKELETAL AS WELL AS THE DENTAL RELATIONSHIP IS BASICALLY A CLASS I PATTERN, BUT SOME WOULD REFER TO THE INCISOR POSITION AS CLASS II. FROM THE CEPHALOMETRIC DATA, WOULD YOU SAY THAT THE LABIO-LINGUAL POSITION OF EACH INDIVIDUAL TOOTH TO ITS BONY BASE IS ACCEPTABLE?

.yes

AVERAGE LABIO-LINGUAL INCISOR POSITION IN BOTH ARCHES, EVEN THOUGH THERE IS SOME EVIDENCE OF PROTRUSION. NOW CONSIDER THE MIXED-DENTITION ANALYSIS. WAS THE PREDICTED SIZE OF THE UNERUPTED CANINE AND PREMOLAR TEETH MORE THAN THE REMAINING SPACE AVAILABLE IN THE MAXILLA?

.no

CORRECT. DOES THE MIXED-DENTITION ANALYSIS SHOW THAT THE MANDIBULAR TOTAL ARCH LENGTH WAS ADEQUATE FOR THE UNERUPTED TEETH?

.yes

FINE. THE MANDIBULAR ARCH LENGTH WAS ADEQUATE. HOWEVER, THE LEFT SEGMENT WAS DEFICIENT (-) 0.3 MM WHILE THE RIGHT SIDE SHOWED AN EXCESSIVE LENGTH OF (+) 0.6 MM. THOUGH THIS DIFFERENCE IS SLIGHT, HOW DO YOU ACCOUNT FOR THE DIFFERENCE?

.slight midline shift ?

GOOD. YOU RECOGNIZED THAT THE MANDIBULAR SEGMENT SHOWED A DEVIATED MIDLINE WHICH WOULD ACCOUNT FOR THE DIFFERENCE IN EACH LATERAL SIDE. HOWEVER, SUCH A DIFFERENCE COULD ALSO OCCUR THROUGH MESIAL DRIFT OF THE MOLARS. WHICH DIAGNOSTIC AID HELPED YOU TO DETERMINE THAT THIS HAD NOT OCCURRED?

.determination of symmetry with dividers

CORRECT. THE MODEL ANALYSIS SHOWED SYMMETRICAL MOLAR POSITION WITH NO EVIDENCE OF MIGRATION. NOW, RETURN TO THE MANDIBULAR INCISOR POSITION. EXCEPT FOR THE SHIFT IN MIDLINE, WHICH DIAGNOSTIC AID DID YOU USE TO DETERMINE THAT THE MANDIBULAR INCISORS WERE IN AN ACCEPTABLE LABIO-LINGUAL POSITION RELATIVE TO THE BASAL BONE?

.cephalometric head film

GOOD. THE HEAD FILM SHOWS THAT THE LABIO-LINGUAL POSITION OF THE LOWER INCISORS WERE QUITE NORMAL. NOW LET'S RETURN TO A CONSIDERATION OF THE MIXED-DENTITION ANALYSIS OF THE MAXILLARY CAST. THE ACTUAL ARCH LENGTH MEASURED FROM MESIAL OF MOLAR TO MESIAL OF MOLAR SHOWED AN EXCESS OF (+) 2.9 MM OF WHICH (+) 1.0 MM WAS THE DIFFERENCE BETWEEN DECIDUOUS AND PERMANENT TOOTH SIZE FROM THE RIGHT AND LEFT SIDES COMBINED. WHERE WAS THE ADDITIONAL SPACE OF (+) 1.9 MM IN THE MAXILLARY ARCH?

.labioversion of maxillary centrals and laterals

FINE. THIS WOULD IMPLY THAT THE DIASTEMA COULD BE CLOSED BY RETRACTING THE INCISORS AND THERE WOULD STILL BE ROOM FOR THE REMAINING TEETH. HOWEVER, THE INCISOR POSITION FROM ONE OF THE DIAGNOSTIC AIDS SHOWED THE RETRACTION OF THESE TEETH SHOULD BE ACCOMPLISHED TO MOVE THEM BODILY AND PRESERVE THE INCLINATION. WHICH DIAGNOSTIC AID INDICATES YOU MIGHT POSSIBLY BE ABLE TO RETRACT THESE TEETH AND STILL PRESERVE THIS NEAR NORMAL INCLINATION?

.cephalometric head film

FINE. THE DENTAL CASTS SHOW A PROTRUSION OF THE UPPER INCISORS WITHOUT CONTACT WITH THE LOWER INCISORS. THUS, RETRACTION IS NOT DIFFICULT (SEE SLIDES 30 AND 33). HOWEVER, IT MUST BE RECOGNIZED THAT (ACCORDING TO THE LATERAL HEADPLATE) THESE INCISORS MIGHT THEN NOT BE IN A POSITION OF THE NORMATIVE CEPHALOMETRIC MEAN THOUGH POSSIBLY ACCEPTABLE. AT THE PRESENT STAGE OF DENTAL DEVELOPMENT, WE WILL HAVE TO ACCEPT THIS DIAGNOSIS.

WHAT ARE THE PRESENT TREATMENT NEEDS IN THE MAXILLA? (ASSUME THERE ARE NO LIMITS ON TIME OR MONEY, AND DON'T CONCERN YOURSELF WITH HOW THE TREATMENT SHOULD BE PERFORMED.)

.a removeable appliance to tip the maxillary centrals and
.laterals lingually

THE SPACED MAXILLARY INCISOR SEGMENT MAY BE RETRACTED 2.9 MM OF TOTAL ARCH LENGTH AND STILL ALLOW SUFFICIENT SPACE FOR UNERUPTED CUSPID AND PREMOLAR TEETH. THIS AMOUNT OF RETRACTION WILL NOT BE SUFFICIENT TO PROVIDE A NORMAL OVERJET AND OVERBITE OF INCISOR CONTACT. THUS, A SLIGHT AMOUNT OF MAXILLARY LATERAL EXPANSION MIGHT BE NECESSARY TO COMPLETE MAXILLARY INCISOR RETRACTION. THE RETRACTION SHOULD BE BODILY MOVEMENT TO PRESERVE THE INCISOR INCLINATION. THE DIASTEMA WILL MOST LIKELY BE CLOSED BY THE RETRACTION.

WHAT ARE THE PRESENT TREATMENT NEEDS IN THE "MANDIBLE"?

.None at present. May later want to produce more cuvature
.in lower anteriors

YOU ARE CORRECT IN DETERMINING THAT NO LABIO-LINGUAL ADJUSTMENT OF LOWER INCISORS IS INDICATED. THE MANDIBULAR SEGMENT HAS SUFFICIENT SPACE FOR NORMAL REPOSITIONING OF THE LATERAL INCISOR AS THE DECIDUOUS CUSPID EXFOLIATES. REMAINING ARCH LENGTH IS SUFFICIENT FOR ERUPTION OF PERMANENT CUSPID AND PREMOLAR TEETH.

AS A GENERAL PRACTITIONER, WOULD YOU TREAT THIS PATIENT YOURSELF RATHER THAN REFERRING HER TO A SPECIALIST?

.yes

I WOULD AGREE THAT THIS CASE IS OF SUCH A NATURE THAT A GENERAL PRACTITIONER COULD HANDLE THE TREATMENT IF HE FEELS CONFIDENT ENOUGH TO DO SO. HOWEVER, THE MAXILLARY INCISORS SHOULD DESIRABLY BE RETRACTED BODILY, THUS REQUIRING OTHER THAN SIMPLE TIPPING ACTION. IF AN ORTHODONTIC REFERRAL IS NOT NECESSARY, AT LEAST THE GENERAL PRACTITIONER WOULD BE WISE TO SEEK CONSULTATION ON THIS POINT OF BODILY MOVEMENT. OTHERWISE, THE CASE APPEARS RELATIVELY CLEAR CUT.

END OF CASE. NOTIFY PROCTOR.

SAMPLE OF PILOT CODING

```
T: YOU ARE CORRECT.  THE MANDIBULAR SEGMENT HAS SUFFICIENT SPACE FOR NOR
MAL REPOSITIONING OF THE LATERAL INCISOR AS THE DECIDUOUS CUSPID EXFOLIA
TES.  REMAINING ARCH LENGTH IS SUFFICIENT FOR ERUPTION OF PERMANENT CUSP
ID AND PREMOLAR TEETH.  NO LABIC-LINGUAL ADJUSTMENT OF LOWER INCISORS IS
 INDICATED.;
Q4CA.2:
A:"TIMA";
C:TALLY RS4;
C:USE SEXTR, USE SCUSP1;
F:REQUIRE 2;
C:BJUMP TO END.Q4CA;
C:MARK Q4FLAG;
C:TALLY RF4;

T: EXTRACTION OF THE MANDIBULAR CUSPIDS TO ALLOW THE LATERAL INCISORS TO
 COME INTO A MORE DESIRABLE POSITION IS A FAVORITE, AND POSSIBLY ACCEPTA
BLE TREATMENT.  HOWEVER, SOME SPACE LOSS COULD OCCUR AS THE RESULT.  SIN
CE THE SPACE ANALYSIS SHOWS THAT NO SPACE LOSS CAN OCCUR, WOULDN'T YOU
AGREE THAT A PASSIVE HOLDING APPLIANCE SHOULD BE INSERTED TO PREVENT SPA
CE LOSS PRIOR TO CUSPID EXTRACTION? ;
Q4CA.3:
C:PUT "TIMA" INTO TEMPA;
A:;
C:USE SYES;
C:BJUMP TO Q4CA.4;

T: GOOD.;
A:"TEMPA";
C:JUMP TO END.Q4CA;
Q4CA.4:
C:USE SNO;
C:BJUMP TO Q4CA.5;

T: WHILE THERE ARE NO CLEAR DATA TO SHOW THAT THE CUSPID SPACES WILL CLO
SE, WE MUST NOT DENY THAT THEY MIGHT. THUS, IT IS GENERALLY ACCEPTED THA
T EXTRACTIONS OF THIS TYPE SHOULD BE PRECEEDED BY PLACEMENT OF A HOLDING
 ARCH. ;
A:"TEMPA";
C:JUMP TO END.Q4CA;
Q4CA.5:
T:ANSWER ONLY YES OR NO, PLEASE.;
C:JUMP TO Q4CA.3;
END.Q4CA:
:P2--Q4--ANTICIPATED WRONG = ;
P2Q4AW:
Q4AW:
A:"TIMA";
C:USE SOPEN, USE SBITE;
F:REQUIRE 2;
C:BJUMP TO Q4AW.3;
C:MARK JFLAG;
C:TALLY WS4, TALLY WF4;
C:IF OPBI.FLAG THEN JUMP TO Q4AW.2, MARK OPBI.FLAG;
Q4AW.1:
C:USE Q3AW.1;
C:JUMP TO Q4AW.3;
Q4AW.2:
C:USE Q3AW.2;
Q4AW.3:
A:"TIMA";
```

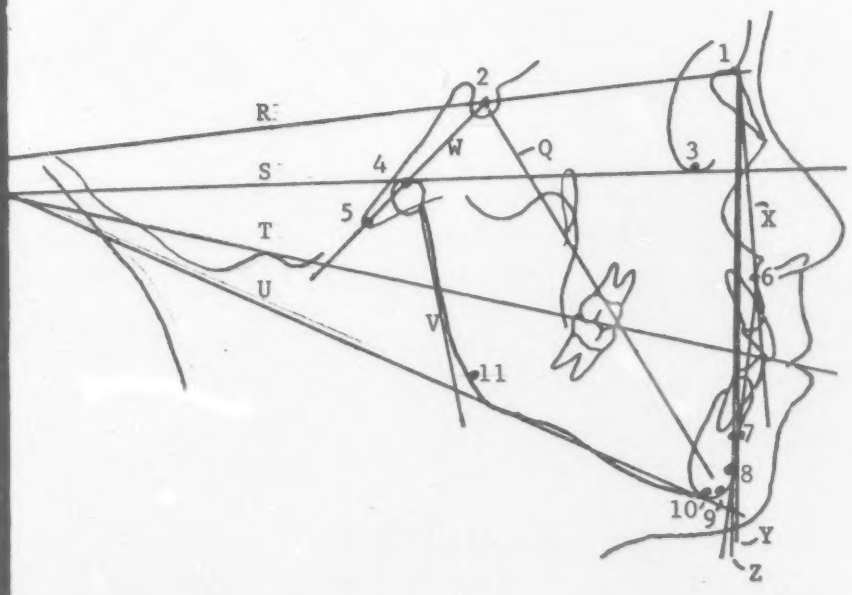
SCREENING TEST

CAI - Space Discrepancies - Screening Test

NAME _____

TIME STARTED: _____

1. Using the diagram below, which represents a lateral cephalometric tracing, identify the numbered anatomic landmarks by matching with the landmark descriptions provided:



Ans. (insert number)

Porion - P ____ = _____
Basion - Ba ____ = _____
Sella - S ____ = _____
Orbitale - O ____ = _____
Nasion - Na ____ = _____
B Point - B ____ = _____
A Point - A ____ = _____
Menton - M ____ = _____
Gonion - Go ____ = _____
Gnathion - Gn ____ = _____
Pogonion - Pog = _____

2. Using the same diagram (above), identify the lettered cephalometric planes by matching with their respective named designation below:

Ans.(insert letter)

Sella-Nasion - SN ____ = _____
Occlusal plane ____ = _____
Facial plane ____ = _____
Nasion - B point - NB = _____
Ramal plane ____ = _____

Ans. (insert letter)

Frankfort Horizontal - FH = _____
Mandibular plane ____ = _____
Nasion - A point - NA ____ = _____
Sella - Basion - SBa ____ = _____
Y Growth Axis ____ = _____

3. Measure and record the following from the tracing in Question #1:

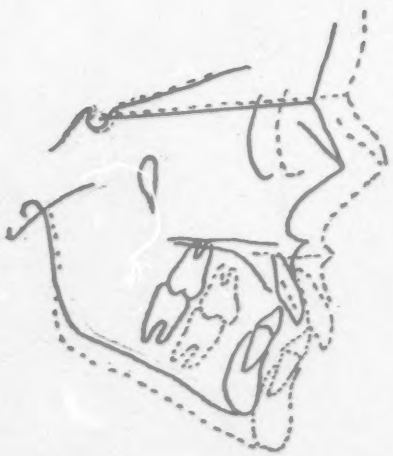
SNA =
SNB =
ANB =
Facial Angle =
Angle of Convexity =
Y Axis =
Occlusal -- SN =
Mandibular -- SN =

. Label each set of data below as a skeletal Class I, II, or III.

	Data #1.	Data #2.	Data #3.	Standard Norms
SNA	76	80	83.5	82
SNB	71	77	85.5	80
ANB	+5	+3	-2	+2
Facial Angle	80.5	86	94.5	87.8
ngle, Convexity	+10.5	+2	-8.5	0
Y--Axis	68	58	52	59.4
Occlusal--SN	21.5	16	10	14.5
Mandibular--SN	35.5	31	26	32
Mandibular--FH	28	21	17	22

ANS. Class_____ Class _____ Class_____

. Classify the skeletal growth pattern of the following



Female

_____10 years

- - - - - - - -16 years

	10 Years	16 Years
SNA	78	78
SNB	74	74
ANB	4	4
Facial ∠	74	75
∠Convexity	+7	+4.5
Y-Axis	68	67
Occl.-SN	18	17
Mand.-SN	31	32
Mand.-FH	33	34

ANS. Class_____ growth pattern

6. On the diagram below, measure and record the angular incisor relation to each other (interincisally):

Ans. _____

7. On the diagram below, measure and record the relation of each incisor to its boney base:

$\underline{1}$ - NA° _____

$\underline{1}$ - NA (mm) _____

$\underline{1}$ - $\overline{1}$ _____

$\overline{1}$ - NB° _____

$\overline{1}$ - NB (mm) _____

$\overline{1}$ - MPA _____

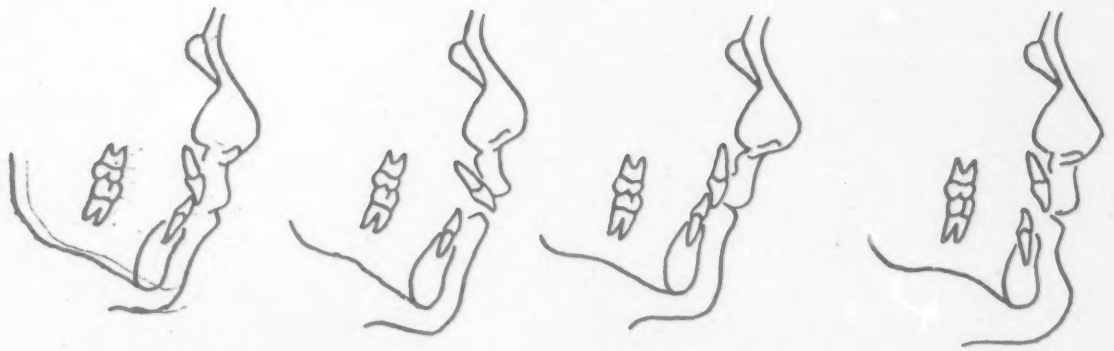
8. Using the choices listed, label each incisor diagram. The occlusion is in centric.

A. Protrusive
B. Retrusive
C. Open
D. Closed (overbite)
E. Crossed
F. Normal
G. Edge to edge

_____ _____ _____ _____ _____ _____

(4)

9. Of the following profiles, which incisor patterns would be acceptable (A), which unacceptable (U) ? Label each - A or U.



_____ _____ _____ _____

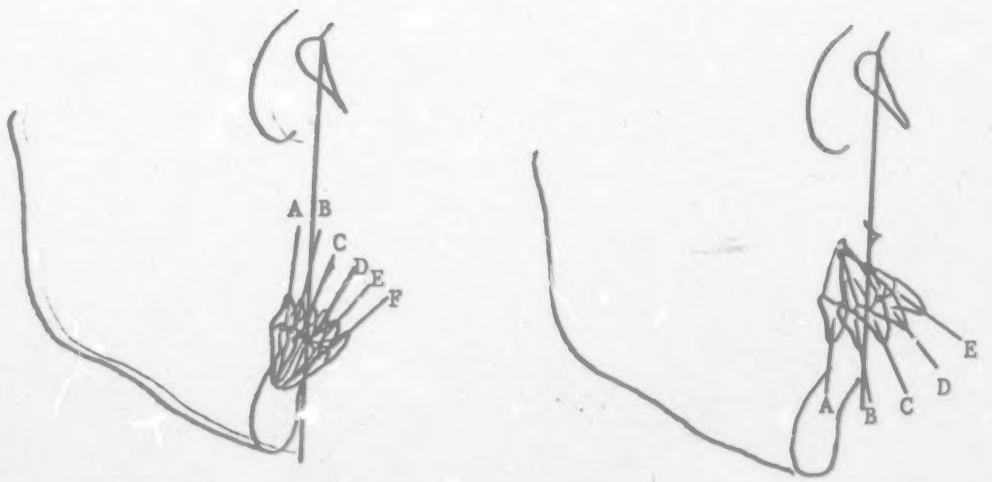
(enroute)

10. Of the following diagrams of cephalometric tracings, which <u>mandibular</u> incisor position might contribute to a space discrepancy or loss of arch length in the <u>mandibular</u> arch

record: _____ _____ _____

Which <u>maxillary</u> incisor position would contribute to a space loss in the <u>maxillary</u> arch?

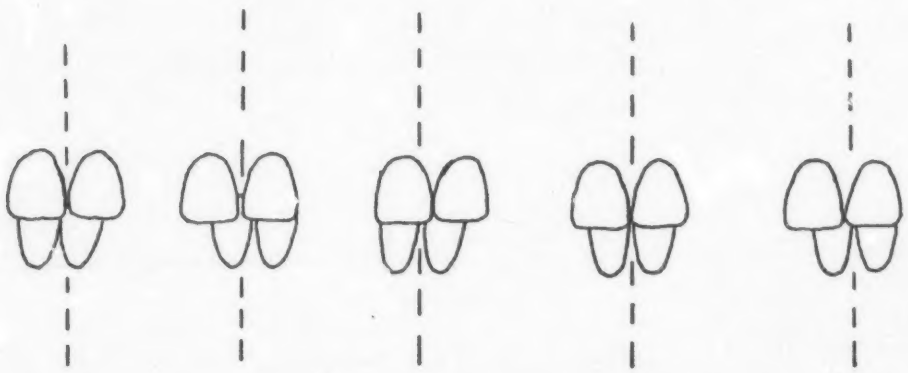
record: _____ _____



(5)

11. Label each dental midline of upper and lower central incisors in the diagrams below. The vertical dotted line represents the midsagittal plane of the cranial skeleton.

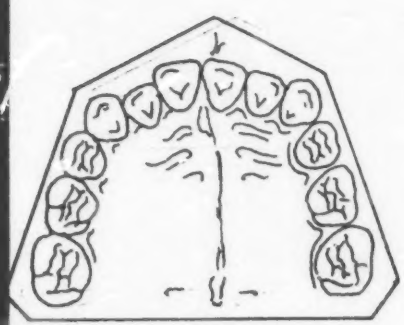
A. Normal
B. Deviates to Right
C. Deviates to Left



ANS.Upper _____ _____ _____ _____ _____

ANS.Lower _____ _____ _____ _____ _____

12. Identify the dental midline in relation to the skeletal midline in the illustration below.



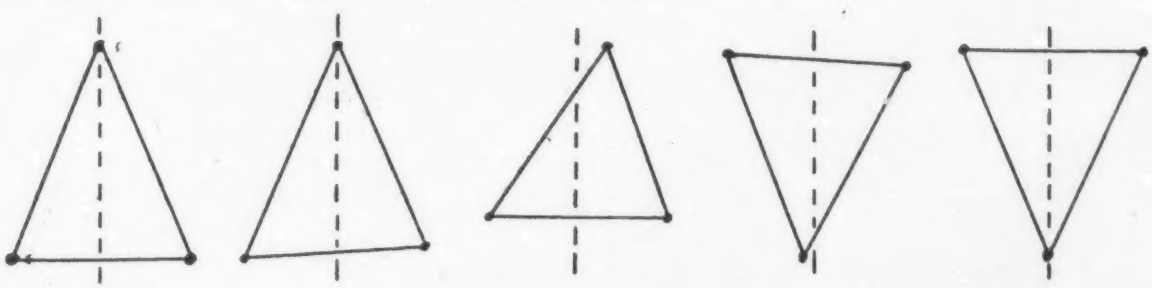
A. Normal (Coincides)

B. Deviates to Right side

C. Deviates to Left side

Answer:_____

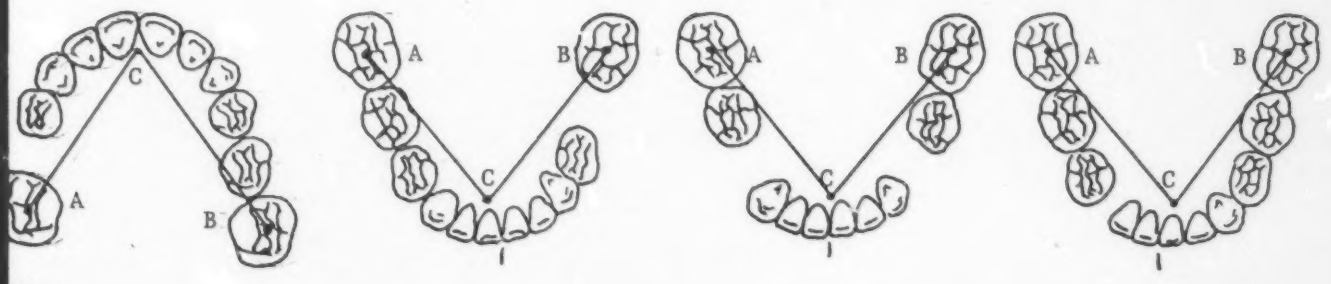
13. Label each following diagram as symmetrical (S) or asymmetrical (A):



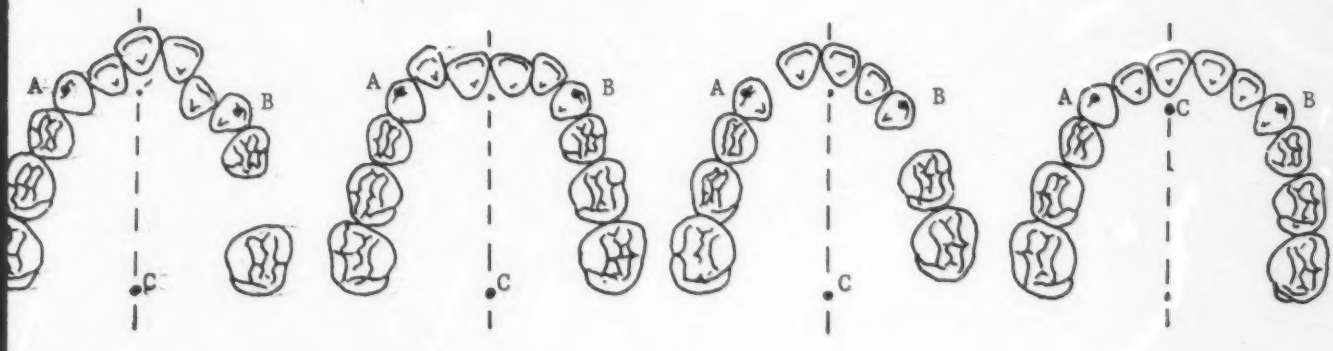
ANS: _____ _____ _____ _____ _____

(6)

4. In each example below, are "A" and "B" in the same ANTERO-POSTERIOR position in relation to "C" ? Label Yes or No.



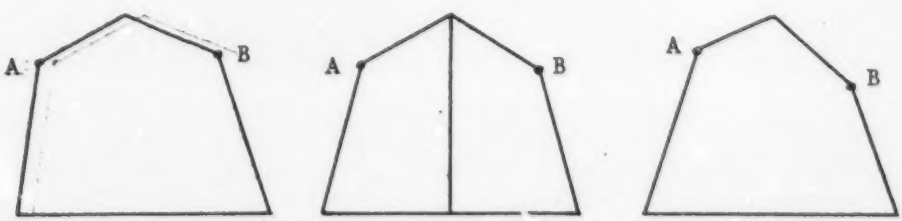
ANS. _____ _____ _____ _____



NS. _____ _____ _____ _____

5. In each diagram below, are points "A" and "B" equidistant in LATERAL position to the ⊥? Label Yes or No.

NS. _____ _____ _____ _____ _____

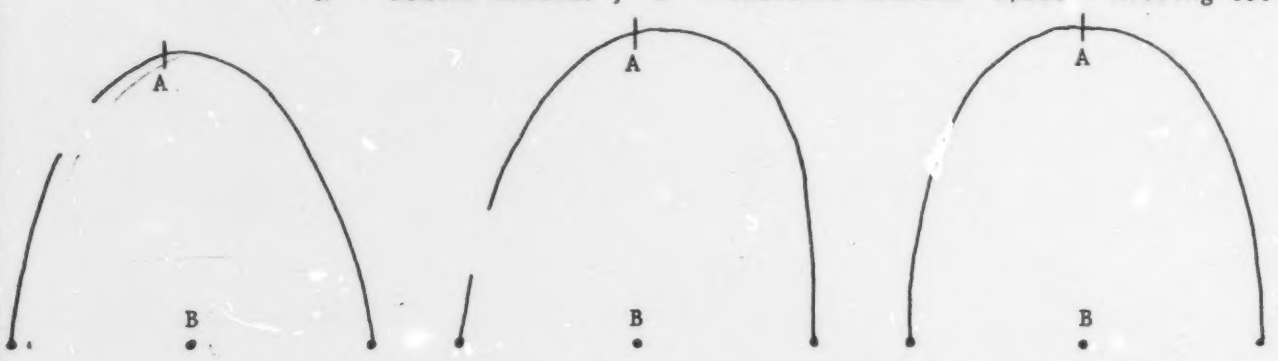


ANS. _____ _____ _____

(enroute)

16. Assuming that the lines diagrammed below represent arcs of central occlusal grooves and incisal edges (or outlines of dental arches), has one side collapsed or the other side expanded? Label yes or no

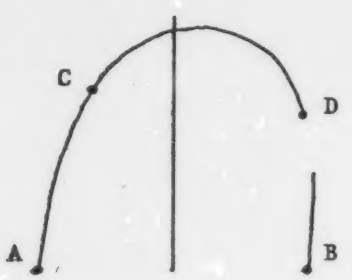
"A" = Dental midline ; "B" = Skeletal midline space = missing tooth



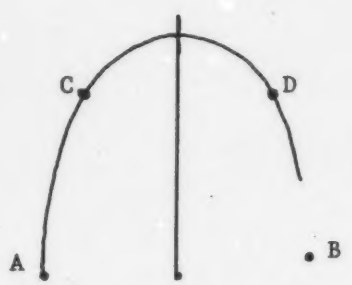
ANS. _____ _____ _____

(enroute)

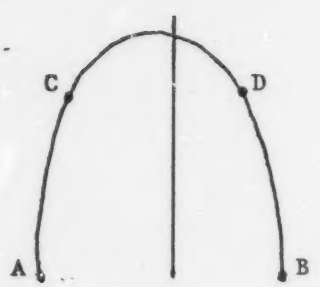
17. On the diagrams below, has molar positions (A & B) or cuspid positions (C & D) in relation to the midpalatine suture served to decrease dental arch length? Label yes or no.



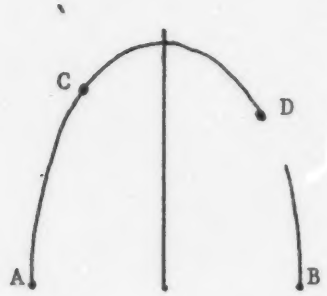
ANS. _____



_____



ANS. _____



_____

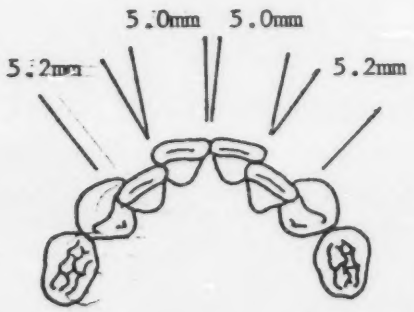
(8)

8. Using the portion of the Michigan-Moyers predictability table given below, Circle the most accurate predicted combined sizes of the unerupted cuspid and premolar teeth if the sum of the mandibular incisors = 22.0 mm.

(LOWER) PROBABILITY CHART FOR PREDICTING SUM OF WIDTHS OF $\overline{3,4,5}$ FROM $\overline{2,1|1,2}$

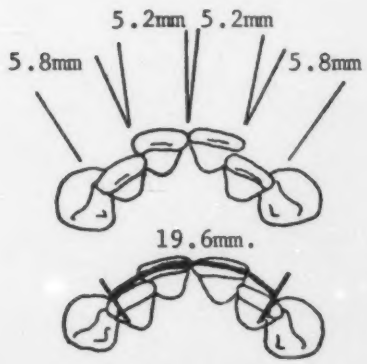
$\Sigma\ \overline{2,1\|1,2}$ =	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0
95%	21.7	22.0	22.3	22.6	22.9	23.2	23.5	23.8
85%	21.1	21.4	21.7	22.0	22.3	22.6	22.9	23.2
75%	20.7	21.0	21.3	21.6	21.9	22.2	22.5	22.8
65%	20.4	20.7	21.0	21.3	21.6	21.9	22.2	22.5
50%	20.0	20.3	20.6	20.9	21.2	21.5	21.8	22.1
35%	19.6	19.9	20.2	20.5	20.8	21.1	21.4	21.7
25%	19.3	19.6	19.9	20.2	20.5	20.8	21.1	21.4
15%	19.0	19.3	19.6	19.8	20.1	20.4	20.7	21.0
5%	18.3	18.6	18.9	19.2	19.5	19.8	20.1	20.4

9. Using the diagram below, indicate how much anterior space is required on each side of the skeletal midline to accommodate the lower permanent central and lateral incisors?



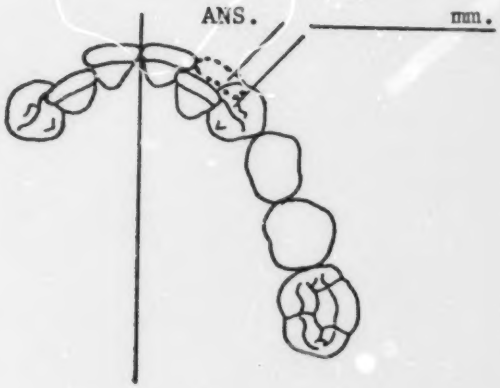
ANS. _____

20. What is the amount of <u>total</u> "incisor liability" in mm. as illustrated below?



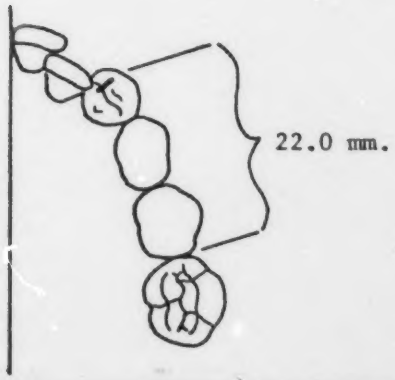
ANS. _____ mm.

21. Using the data in the ABOVE diagrams, record the incisor liability in mm. on the illustration below:



22. Using the diagram below, and the chart furnished in Question # 18, what is the comparison between remaining space available in the arch quadrant and the predicted combined size of the unerupted cuspid and premolar teeth?

Sum of the incisors = 22.0 mm.



ANS. Complete the following statement:

The predicted tooth size is _____ mm.

{larger / smaller} than space available in the quadrant.

TIME COMPLETED: _____

TABLES OF SCORES

Screening Test

	Tot pts.	Pts. Pre Req.	Pts. EnRt.	Pts. To Qualify
Part 1	56	51	5	38
Part 2	39	32	7	23
Part 3	6	6	0	4

Means and Standard Deviations

	Field Test Sample	Remaining Students
Part 1/Prereq.	$M_1 = 8.1$, $S_1 = 2.7$	$M_1 = 11.8$, $S_1 = 6.4$
Part 1/Enroute	$M_2 = 3.1$, $S_2 = 2.2$	$M_2 = 4.0$ $S_2 = 1.7$
Part 2/Prereq	$M_3 = 2.8$, $S_3 = 1.6$	$M_3 = 3.6$ $S_3 = 3.2$
Part 2/Enroute	$M_4 = 2.0$, $S_4 = 1.3$	$M_4 = 1.8$ $S_4 = 0.7$
Part 3/Prereq.	$M_5 = 1.2$, $S_5 = 0.6$	$M_5 = 3.3$ $S_5 = 1.6$

Screening Test Attitude Question

Field Test Sample	Remaining Students
M = 6.9, S = 1.8	M = 6.5, S = 1.7

t = 60, df = 56

(no significant difference)

Screening Test Time

Field Test Sample	Remaining Students
M = 42.0, S = 6.1	M = 40.0, S = 7.4

TABLES OF SCORES

Diagnosis Test

EXPERTS	Case #2	Case #5	Case #3	Case #6
1	89			74
2	81			95
3	70			57
4	68			82
5		88	49	
6		86	63	
7	67	68	64	78
8	95	76	83	84
9	99	83	93	85
10	80	62		
11	74	77	55	62
12	54	78		
TOTAL OF ALL	777	618	407	617
AVE OF ALL	77.7	77.3	67.8	77.1
AVE OF TEST	77.5		72.5	
MIN STD	80		70	

TABLES OF SCORES

Diagnosis Test

STUDENTS	Case 2 SCORE	Case 2 TIME/TX RESP	Case 5 SCORE	Case 5 TIME/TX RESP	Case 2 + 5 TOT SCORE	Case 2 + 5 AVE SCORE	Case 3 SCORE	Case 3 TIME/TX RESP	Case 6 SCORE	Case 6 TIME/TX RESP	Case 3 + 6 TOT SCORE	Case 3 + 6 AVE SCORE	CONDITION
1	78	20y	58	10n	136	68(-)	78	30n	55	30n	133	66.5(-)	- -
2	52	29y	42	15n	94	47(-)	86	28n	74	26n	160	80(+)	- +
3	85	30n	65	20n	150	75(-)	75	15n	69	35y	144	72(+)	- +
4	82	28y	93	13y	175	87.5(+)	55	21n	66	20y	121	60.5(-)	+ -
5	71	15y	77	15n	148	74(-)	73	18y	64	29n	137	68.5(-)	- -
6	56	40y	70	21n	126	63(-)	85	20y	62	18n	147	73.5(+)	- +
7	65	17y	90	9y	155	77.5(-)	87	20y	76	20n	163	81.5(+)	- +
8	82	22y	80	15y	162	81(+)	79	22n	74	24n	153	76.5(+)	+ +
9	84	42y	93	30y	177	88.5(+)	80	38n	83	25n	163	81.5(+)	+ +
10	58	32n	70	25n	128	64(-)	74	25n	54	30n	128	64(-)	- -
11	62	38y	87	28y	149	74.5(-)	81	15y	59	20y	140	70(+)	- +
12	92	30n	86	15n	178	89(+)	67	25n	83	22n	150	75(+)	+ +
13	66	27y	66	25n	132	66(-)	86	24n	77	30n	163	81.5(+)	- +
14	66	35y	95	15n	161	80.5(+)	53	35n	55	25n	108	54(-)	+ -
15	80	25y	62	15n	142	71(-)	76	30n	66	30n	142	71(+)	- +
16	78	28y	74	10y	152	76(-)	73	25n	69	15n	142	71(+)	- +
17	76	29y	88	22y	164	82(+)	71	35n	80	27y	151	75.5(+)	+ +
18	62	32n	58	20n	120	60(-)	74	30n	77	22n	151	75.5(+)	- +
19	71	21n	75	18y	146	73(-)	71	30n	60	13n	131	65.5(-)	- -
20	56	27y	94	15y	150	75(-)	77	27n	66	26n	143	71.5(+)	- +
21	79	30n	94	30n	173	86.5(+)	85	25y	90	30n	175	87.5(+)	+ +
22	79	25n	92	15n	171	85.5(+)	91	27y	81	31n	172	86(+)	+ +
23	56	52y	51	25y	107	53.5(-)	71	25y	66	28n	137	68.5(-)	- -
TOT/CASE	1636	674	1760	426	3396	1698	1748	590	1606	576	3354	1677	
AVE/CASE	71	29	77	19	74	74	76	26	70	25	73	73	
TOT TX RESP		16y7n		10y13n				7y16n		4y19n			

TABLES OF SCORES

Attitude Questionnaire

STUDENTS	FORM A PART 1	FORM B PART 1	FORM A PART 2	FORM B PART 2	FORM A TIME	FORM B TIME
1	140	130	85	80	7	9
2	134	134	77	83	9	8
3	144	138	81	79	10	7
4	125	129	78	78	17	12
5	142	115	81	84	8	5
6	116	125	79	69	15	5
7	137	144	75	77	16	9
8	149	149	79	83	8	7
9	147	131	84	81	9	6
10	134	128	84	84	14	10
11	127	134	69	75	11	7
12	115	122	75	72	10	10
13	120	128	85	83	7	8
14	135	123	70	80	10	8
15	107	90	63	79	9	10
16	94	103	71	71	15	10
17	126	131	75	82	7	12
18	123	132	74	80	8	13
19	135	133	72	79	8	7
20	126	133	68	72	7	5
21	124	120	73	72	10	10
22	111	100	84	85	7	9
23	125	121	73	71	8	15
TOT	2937	2893	1755	1799	230	202
AVE/TOT	128	126	76	78	10	9
AVE/ITEM	3.6	3.5	3.8	3.9		

TABLES OF SCORES

Computer Response Capability

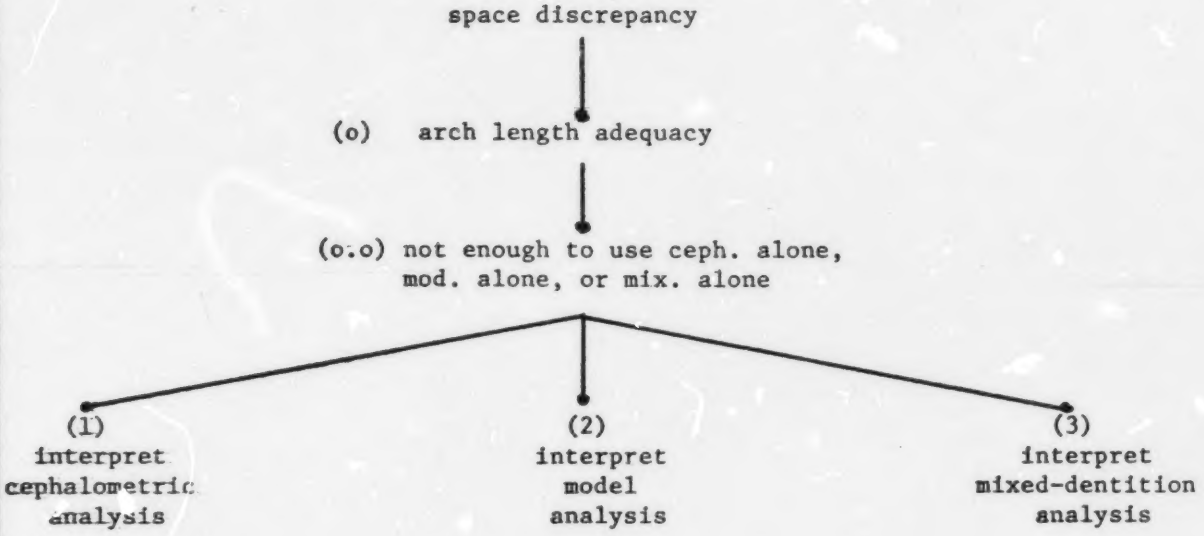
	CASE 1				CASE 2				
STUDENTS	G_1	M_1	B_1	TOT_1	G_2	M_2	B_2	TOT_2	TOT_{12}
1	23	1	1	25	19	5	0	24	49
2	22	6	0	28	20	2	0	22	50
3	19	2	2	23	21	0	0	21	44
4	27	4	1	32	21	8	3	32	64
5	28	8	0	36	19	0	0	19	55
6	27	5	2	34	20	1	0	21	55
7	23	0	1	24	23	2	3	28	52
8	24	3	4	31	25	1	2	28	59
9	23	2	0	25	20	3	1	24	49
10	20	5	0	25	19	6	0	25	50
11	21	0	1	22	23	3	1	27	49
12	29	2	1	32	21	1	5	27	59
13	21	3	2	26	21	1	2	24	50
14	26	3	0	29	19	0	3	22	51
15	28	3	1	32	16	0	0	16	48
16	23	6	1	30	20	1	0	21	51
17	21	3	0	24	18	1	0	19	43
18	24	2	0	26	20	1	0	21	47
19	26	5	3	34	19	0	1	20	54
20	23	2	1	26	21	3	0	24	50
21	26	1	0	27	23	0	2	25	52
22	23	3	1	27	18	4	2	24	51
23	21	10	0	31	19	4	2	25	56
TOT	548	79	22	649	465	47	27	539	1188
%	46	7	2	55	39	4	2	45	100

$G_1 + G_2$ 85%

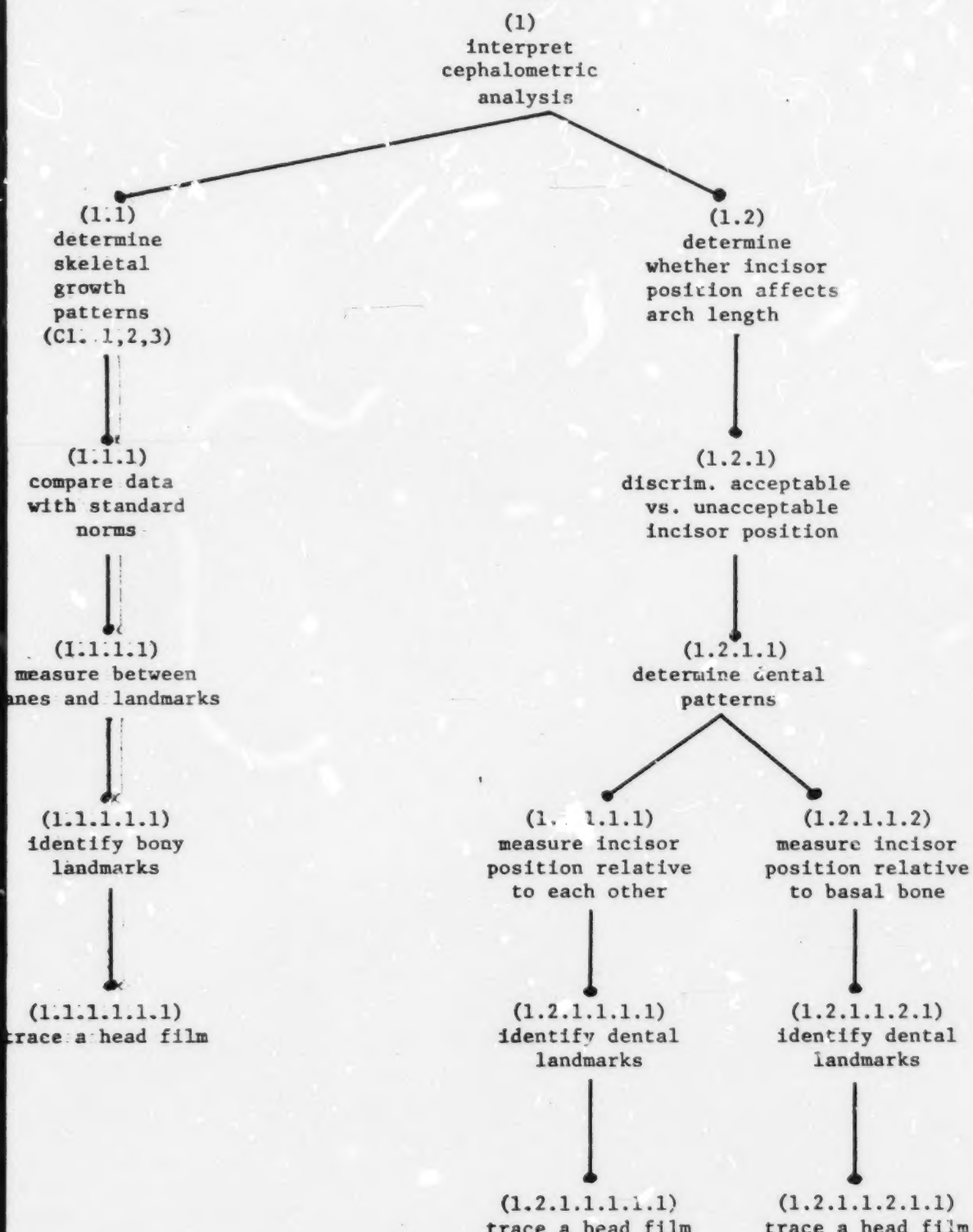
$M_1 + M_2$ 11%

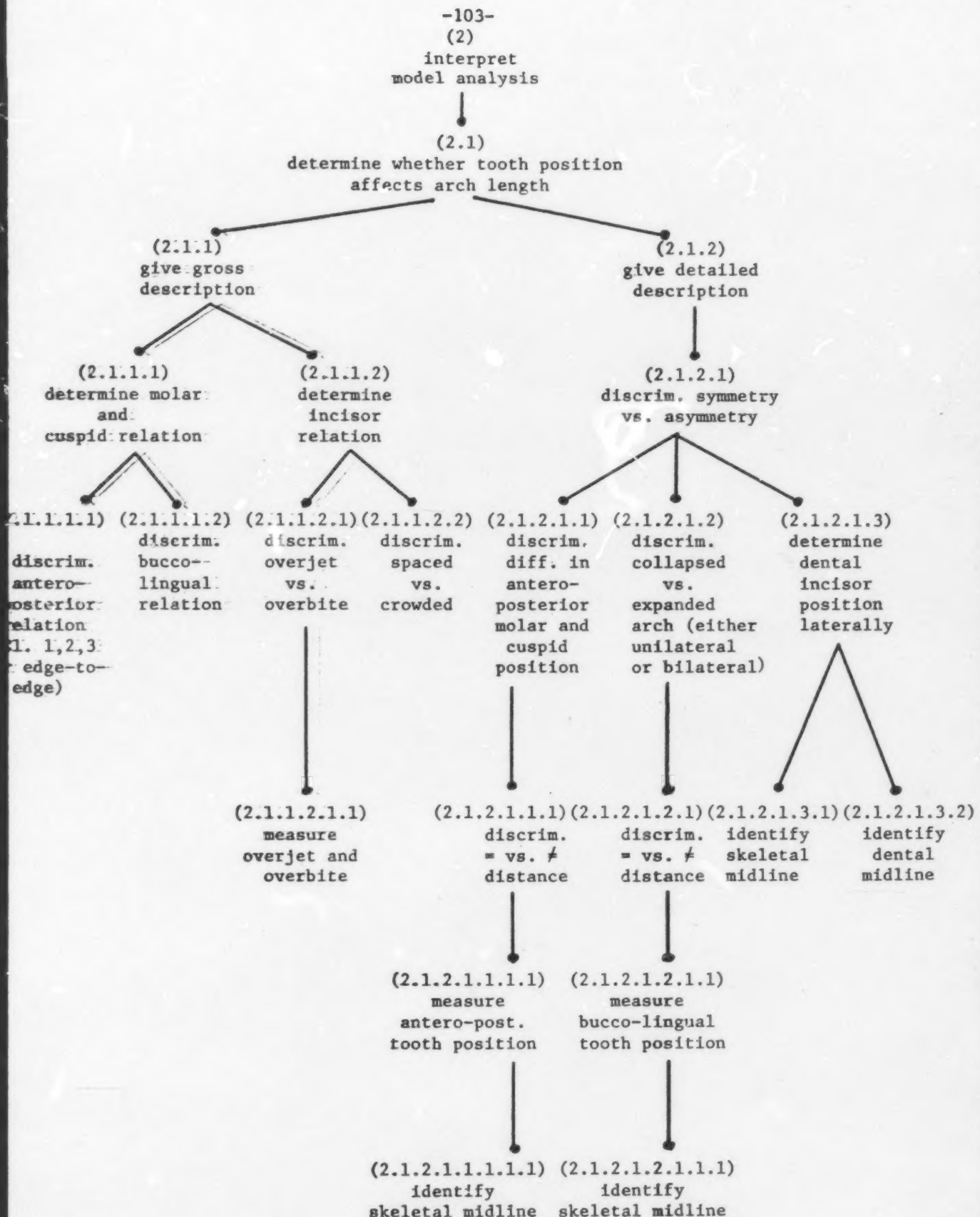
$B_1 + B_2$ 4%

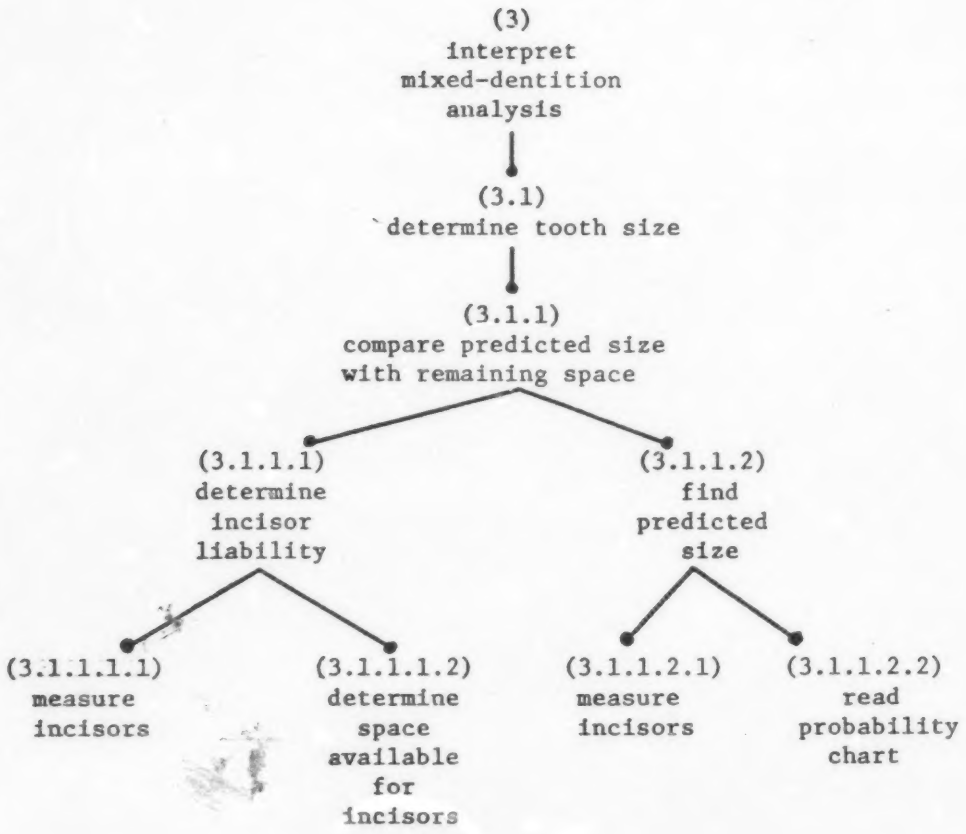
TASK ANALYSIS TREE *


space discrepancy
(o) arch length adequacy
(o.o) not enough to use ceph. alone, mod. alone, or mix. alone
(1) interpret cephalometric analysis
(2) interpret model analysis
(3) interpret mixed-dentition analysis

* The lexicographic numbers in parenthesis refer to the corresponding "Cognitive Objectives."


(1)
interpret
cephalometric
analysis
(1.1)
determine
skeletal
growth
patterns
(Cl. 1,2,3)
(1.2)
determine
whether incisor
position affects
arch length
(1.1.1)
compare data
with standard
norms
(1.2.1)
discrim. acceptable
vs. unacceptable
incisor position
(1.1.1.1)
measure between
anes and landmarks
(1.2.1.1)
determine dental
patterns
(1.1.1.1.1)
identify bony
landmarks
(1. 1.1.1)
measure incisor
position relative
to each other
(1.2.1.1.2)
measure incisor
position relative
to basal bone
(1.1.1.1.1.1)
trace a head film
(1.2.1.1.1.1)
identify dental
landmarks
(1.2.1.1.2.1)
identify dental
landmarks
(1.2.1.1.1.1.1)
trace a head film
(1.2.1.1.2.1.1)
trace a head film


(2)
interpret
model analysis
(2.1)
determine whether tooth position
affects arch length
(2.1.1)
give gross
description
(2.1.2)
give detailed
description
(2.1.1.1)
determine molar
and
cuspid relation
(2.1.1.2)
determine
incisor
relation
(2.1.2.1)
discrim. symmetry
vs. asymmetry
(2.1.1.1.1)
discrim.
antero-
posterior
relation
(1, 1,2,3
edge-to-
edge)
(2.1.1.1.2)
discrim.
bucco-
lingual
relation
(2.1.1.2.1)
discrim.
overjet
vs.
overbite
(2.1.1.2.2)
discrim.
spaced
vs.
crowded
(2.1.2.1.1)
discrim.
diff. in
antero-
posterior
molar and
cuspid
position
(2.1.2.1.2)
discrim.
collapsed
vs.
expanded
arch (either
unilateral
or bilateral)
(2.1.2.1.3)
determine
dental
incisor
position
laterally
(2.1.1.2.1.1)
measure
overjet and
overbite
(2.1.2.1.1.1)
discrim.
= vs. ≠
distance
(2.1.2.1.2.1)
discrim.
= vs. ≠
distance
(2.1.2.1.3.1)
identify
skeletal
midline
(2.1.2.1.3.2)
identify
dental
midline
(2.1.2.1.1.1.1)
measure
antero-post.
tooth position
(2.1.2.1.2.1.1)
measure
bucco-lingual
tooth position
(2.1.2.1.1.1.1.1)
identify
skeletal midline
(2.1.2.1.2.1.1.1)
identify
skeletal midline


(3)
interpret
mixed-dentition
analysis
(3.1)
determine tooth size
(3.1.1)
compare predicted size
with remaining space
(3.1.1.1)
determine
incisor
liability
(3.1.1.2)
find
predicted
size
(3.1.1.1.1)
measure
incisors
(3.1.1.1.2)
determine
space
available
for
incisors
(3.1.1.2.1)
measure
incisors
(3.1.1.2.2)
read
probability
chart

USER MANUAL

Introduction

This manual is a guide to computer-terminal operation for those who are going to interact with the computer while practicing the diagnosis of space management cases in dentistry.

There are at least three types of computer terminals which can be used: the IBM 2741, the Datel, and the teletype terminals. Instructions for operating each of these terminals will be included in the manual. Please note that whenever these instructions call for pressing the RETURN key of the IBM 2741 or the Datel terminals, the corresponding operation on the teletype terminal would be to press the D key while holding down the CTRL key. Similarly, pressing the ATTN key of the IBM 2741 or the Datel terminals would be accomplished on the teletype terminal by pressing the E key while holding down the CTRL key.

There is a regular schedule of hours when the computer terminal is available for use. From Monday through Friday the terminal systems are available from 9:30 A.M. until noon, from 1:30 P.M. until 6 P.M., and from 7:30 P.M. until 7 A.M. Terminal systems are also available throughout the weekend except from 5 P.M. until 11 P.M. Saturday and Sunday evenings.

For easy reference, the sections of this manual (followed by the page number) are listed below:

Introduction (1)
Beginning the Session with SIGN-ON (1)
STARTing the Program (3)
RESTARTing the Program (4)
SKIP Option (5)
Typing and Entering the Response (5)
Continuing the Response (5)
Correcting the Response (5)
Delayed or Unsatisfactory Responses (6)
Ending the Session with SIGN-OFF (6)
Typing Exercises (7)
Appendix: Trouble Sheet (8)

Beginning the Session with SIGN-ON

Before you begin a terminal session make sure the terminal is turned on and the local-remote switch is set to "local." The public terminals located at the computer center will already be in this condition when you arrive.

Set the left margin at 5 and the right one at 65. Then take the following steps.

1. Dial in to establish a link between your terminal and the computer. (The public terminals located at the computer center are directly and permanently wired to the computer. When using these terminals commence at step 3.) The number to dial for IBM 2741 terminals or Datel terminals is 665-3111; there are a total of nine lines available from this number. (Through the UC tie-line system, dial 776-9168.) For teletype terminals the numbers are 665-3300, 665-3301, 665-3302, and 666-1972; there is one line available on each of these numbers.

When you dial one of the above numbers, you will normally hear one or two rings and then a tone. If this happens, go to step 2.

If you dial in and get a busy signal, this means all the lines are in use, and you should begin again at step 1 later.

If you dial in and hear the telephone ringing but do not get a busy signal or a tone, this usually means that the terminal systems are not in operation. Occasionally there are times during the normal operating hours when the computer terminal systems are not functioning correctly. You can call the computer operator at 666-2643 for an estimate of when you can dial in and expect normal operation.

2. Start with the coupler switch turned off, and notice the sign indicating where the cord end of the telephone handset should be placed. When you dial in and hear a tone, put the telephone receiver into the coupler and turn the coupler switch on. Then turn the local-remote switch to "remote."

If you have made a good connection, the keyboard of the 2741 will unlock with a soft click. On the Datel terminal the blue READY light and the green PROCEED light will turn on and the keyboard will unlock. On the teletype terminal there is no indicator.

3. To initiate the sign-on procedure, press the RETURN key. (On the teletype terminal, enter S, Y, or 0 to indicate whether your terminal is supported at 10, 15, or 30 characters per second, respectively.)

You have now signaled the computer that you wish to sign on, and you should get the following message ....

```
UCSF TELEPROCESSING
SELECT PROCESSOR OR TYPE ? FOR HELP
```

If you do not get this message, begin again at step 1. If after the second try, you still do not get this message, you can call the computer operator at 666-2643 for assistance.

4. Type the word PILOT and press the RETURN key. (You may use either upper or lower case whenever typing to the computer.)

5. First you will be asked for your name. Type in your last name, and press the RETURN key.

6. After you supply your last name you will be asked for your account number. At this point you should type in 1084 and press the RETURN key.

7. When you have supplied your last name and a valid account number, your terminal will be signed on to the PILOT system and under the control of the PILOT MONITOR. The computer will ask for your request, type a period at the left margin, and then wait. Your interaction up to this point will look like the following ....

```
UCSF TELEPROCESSING
SELECT PROCESSOR OR TYPE ? FOR HELP
pilot
WHAT IS YOUR NAME?  lastname
WHAT IS YOUR ACCOUNT NUMBER?  1084

++++++++++++++++++++++++++++++++++++

10:38:49 AM, TUESDAY JUNE 16, 1971
PILOT - VERSION 1.5

++++++++++++++++++++++++++++++++++++

THIS IS THE PILOT MONITOR
ENTER REQUESTS OR "?" FOR HELP

.
```

8. At this point you should either START or RESTART the program, as directed below.

STARTing the Program

To START the program (after the computer has asked for your request and has typed a period at the left margin), type START CASE1 and press the RETURN key. The computer will then ask for a password (and again will type a period at the left margin). Type in your last name and press the RETURN key. The computer will then give you a RESTART

number and will ask you to verify the data collected so far. A typical START sequence might look like the following ....

```
THIS IS THE PILOT MONITOR
ENTER REQUESTS OR "?" FOR HELP

.start case1

PASSWORD?

.lastname

YOUR RESTART NUMBER IS '3'

REQUEST: START 'CASE1' WITH PASSWORD 'LASTNAME'
AND RESTART NUMBER '3'
CORRECT?

.yes

OK

++++++++++++++++++++++++++++++++++
```

RESTARTing the Program

In order to continue a program at a point where you left off before, you should RESTART rather than START when the computer asks for your request. You will have to give your password and restart number when requested. A typical RESTART sequence might look like the following ....

```
THIS IS THE PILOT MONITOR
ENTER REQUESTS OR "?" FOR HELP

.restart case1

PASSWORD?

.lastname

RESTART NUMBER?

.3

REQUEST: RESTART 'CASE1' WITH PASSWORD 'LASTNAME'
AND RESTART NUMBER '3'
CORRECT?

.yes

OK

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SKIP Option

If you have any trouble RESTARTing the program, you will have to START the program instead and then use the SKIP option to skip to a point within the program. When the program begins, this sentence will be typed to you ....

> ENTER THE NUMBER 0 TO BEGIN UNLESS YOU HAVE BEEN DIRECTED TO USE THE SKIP OPTION.

If you are using the SKIP option, your response should be a number from 1 to 5. Choose and type the number which will bring you closest to the part of the program at which you last discontinued. (You may have to re-request some diagnostic aids or re-answer some questions.)

1 to request a diagnostic aid
2 to answer the question about diagnosis
3 to answer the question about maxillary treatment needs
4 to answer the question about mandibular treatment needs
5 to answer the question about treatment responsibility

Typing and Entering the Response

You can tell when the program is ready for you to type something because the carriage will move to the left margin, type a period, and the keyboard will unlock. Your response may then be typed; use of capital letters and punctuation is optional. Most of the time, your response can be in your own words, but please do not use abbreviations. When you have finished typing your response, you should signal the computer by pressing RETURN. You needn't feel rushed when entering a response, as you are not tying up the computer while you are thinking.

Continuing the Response

If your response takes more than one line (that is, you reach the right margin), you may press RETURN to continue typing on the next line. (Do not end a line in the middle of a word. If you reach the right margin before you finish a word, backspace over the word and retype it on the next line.) When you have finished typing the entire response, press RETURN again. If the computer follows with typing a period at the left margin of the next line (This will occur if you have typed more than 60 characters on the line.), you must press RETURN still another time.

Correcting the Response

There are two ways to correct errors. The first allows you to correct part of the line. On the IBM 2741 and the

Datel terminals, for each character that you want to erase, press the backspace key. When you backspace over a character, the character is erased; therefore, you will have to retype the remainder of the line. For example, if you have typed "denistry" and have backspaced to correct the spelling to "dentistry," you will have to retype the letters "istry" since they will have been erased by the backspacing procedure. Be sure that the typing element is at the end of the response before you enter the response. On the teletype terminal, for each character that you want to erase, press the 'o' key while holding down the SHIFT key. Each time an arrow is typed, the next left-most letter is erased (even though the typing element does not actually backspace). Continue typing the correct characters following the arrows.

The second allows you to erase the entire line by pressing the ATTN key. When you press ATTN instead of pressing RETURN, the whole line will be ignored and you will get the message "+++TYPE AGAIN+++." (Note that ATTN must not be pressed if you have already pressed RETURN for this particular response; doing so would cause your program to be discontinued.)

Delayed or Unsatisfactory Responses

Once you have typed your response and pressed the RETURN key, there may be a variable amount of time before the computer returns a message. The computer may be working on many jobs at once, and the variable delay is partially dependent on how much other work is in progress at the time.

The delay will rarely be longer than one minute, and is usually much less. If the keyboard remains locked so that you are not able to type in your next response after three minutes or more, you should check the "Trouble Sheet" (in the Appendix) for directions. Also check the "Trouble Sheet" if you are getting any other sort of unsatisfactory responses.

Ending the Session with SIGN-OFF

If you want to discontinue the program with the option of later RESTARTing it where you left off, simply wait until the computer types a period and unlocks the keyboard, then type $QUIT. (When you wish to RESTART the program, you must have available your password and RESTART number.) If you do not want the option of RESTARTing later, type $QUIT(NOSAVE). In either case, control of the terminal will be returned to the PILOT MONITOR. You will then be allowed to either START or RESTART the program or to terminate the session by typing $QUIT again. The following example shows how to terminate a session and to SIGN-OFF from the computer ....

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.$quit(nosave)
OK

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STATUS OF PROGRAM NOT SAVED
REQUEST?

.$quit
OK
TO TERMINATE SESSION HIT ATTN - TO CHOOSE ANOTHER
PROGRAM HIT RETURN
(STUDENT HITS THE ATTN KEY)
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Typing Exercises

1. Type the following characters (Remember to use the SHIFT key when necessary.):

   ? : p .. 1! L 8 0 o %

2. Type your last name, then erase the entire line.

3. Type "denistry," then backspace to correct the spelling.

4. Type a brief description of the typing experience you've had in the past.

APPENDIX: Trouble Sheet

The problems listed below have occurred in the past and may not have been corrected yet by the computing facility staff or by the programmer of this program. Please try to circumvent the problems by following the directions in this trouble sheet. If your efforts prove to be useless, you can call the proctor for help **or call the computing facility at 666-2643.**

1. If the computer stops responding in one way or another and if your terminal is connected to the computer through a phone line attached to a coupler, check to see whether the coupler light is on. If it is off, you will have to redial and then RESTART the program.

2. If you are on a Datel terminal and the keyboard locks, check to see whether the blue READY light is on. If it is off, you will have to redial and then RESTART the program. If it is on, your keyboard should unlock when the green PROCEED light turns on. If the PROCEED light does not turn on within at least three minutes, press the ATTN key, wait for the computer to ask for your request, and then RESTART the program.

3. There has been trouble with the RESTART feature. If the computer does not allow you to RESTART, you will have to START instead and then use the SKIP option. If the computer does allow you to RESTART, there still may be trouble in that you may not be RESTARTed exactly where you discontinued, or the program may not understand a perfectly good response from you. Try to continue responding as best you can.

4. If the computer stops typing before the line is finished and does not continue within at least 3 minutes, try pressing the RETURN key. If the computer types "INVALID REQUEST," you will have to RESTART the program.

5. If the keyboard locks after the computer types a period, try to type your response periodically for at least 3 minutes. If the keyboard remains locked, you will have to press the ATTN key and then RESTART the program when the computer types "REQUEST?".

6. If you are getting unsatisfactory responses from the computer for no apparent reason, check the spelling of the important words in your answer. Try repeating the answer with the correct spelling. Also check any prior instructions that were given to you to see if you are following directions properly.

7. If you have pressed RETURN in order to continue typing your answer on the next line, the computer should

type a period at the beginning of the line and then wait for you to continue typing. If the computer does not type the period, chances are the line you just finished typing was not received by the computer. Try to re-type the line.